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APPLICATION OF RESEARCH

IT is a generally accepted principle that research results must be applied to the practical affairs of life before they can become fruitful. There are certain "pure" scientists, known even among their fellows as "the purest of the pure," who would maintain that research is self-sufficient; but they may be dismissed as an impractical minority. There are others who may maintain the more logical view that a given research may be incapable of application, but may lead imperceptibly to a practical application of immense value to the human race. Those who hold this view can point to many examples, among which need only be mentioned the apparently "impractical" experiments in magnetism and electricity of the early nineteenth century, which in due season led to the rise of the great electrical industry. In more recent times they may point to the wealth of work expended upon the structure of the atom which led, with the inevitableness of a Greek tragedy, to the atomic bomb and will lead to an entirely new method of producing power and medicinal substances. The truth is that pure research should always be pursued, and pursued at the will and whim of the experimenter not directed necessarily to objects that will have immediate practical application. There must always be scientific workers, thinkers in every form of learning—not of science only—who have their heads well in the air. Research may be inexplicable to the layman; it may even be unexplainable to him. Nevertheless when some practical possibility results from the researches of those whose heads are in the air, that possibility must be explained to those whose feet are on the ground.

These reflections have a bearing on the passage dealing with research in the Presidential Address to the North British Association of Gas Managers given by Mr. J. M. Dow. Mr. Dow confesses that having lately attended an Autumn Research Meeting of the Institution for the first time, he "completely failed to appreciate its value." He added that "this may have been due to the fact that the majority of the subjects discussed were entirely above my head, and apart from one or two exceptions bore little relationship to the everyday problems confronting the gas engineer in his efforts to provide a better service to the consumer." Mr. Dow referred to a feeling of frustration that crept over him after listening to the learned deliberations of the research team, and failed to find any information arising from that meeting that he could apply to his particular problems. In that puzzlement, Mr. Dow is not alone. We ourselves have had a similar experience. We do not only refer here to the Autumn Research Meeting of the Institution of Gas Engineers. On how many occasions have we been induced by an attractive title to spend a couple of hours in hearing a discourse on a subject which promised to add to our store of knowledge, only to leave us sadly reflecting that the time had been wasted for the subject was utterly beyond our understanding. To-day one requires to be something of a specialist to understand the directions in which progress is being made in the discovery of new knowledge. For lack of such understanding, Mr. Dow blames the research men. His blame is refreshingly downright and outspoken: "It is generally recognized that the true research worker is born, not made, and that our Industry probably does not attract the type of men we are looking for; but surely members of the Gas Research Board can infuse a little less of the unreal into the choice of subject, and follow a humbler and more constructive course on problems that will evolve more factual knowledge on things in keeping with the common touch."

This is a serious allegation. In good round terms reminiscent of Hanoverian England it states that the staff of the Gas Research Board "are not the men we are looking for," and by inference that they are not suitable to the needs of the Gas Industry. It argues that long-range projects involving research having no immediate application should not be followed, but that the Gas Research Board should devote its energies to problems of which the solution will prove of immediate benefit to the Industry. Mr. Dow is not alone in his views; similar views have been put to us on many occasions. They are therefore worth careful consideration.

RESPONSIBILITY

LET us, as the first step, absolve the workers of the Gas Research Board of any responsibility in the matter of the choice of research. Ultimately, it is the members of the Gas Industry who form the Board who must take the responsibility for the choice of subjects. It is highly unlikely that a major research subject would be undertaken without the consent of the Board. The members of the research teams must, however, take the responsibility for the manner in which the results of research are presented.

On this second aspect of the question we have expressed ourselves forcibly on previous occasions. We have not scrupled to state our conviction that research reports presented to the Institution meetings should be written in language that can be undersood by the people and that the practical conclusions should not be wrapped up in the language of science—a form of words as different from English as English is from colloquial American—but should be clearly stated so that they can be understood by those who have no scientific training. Only a week or so ago, Mr. Geoffrey Heyworth, who as Head of the great Lever combine has evidently suffered under the infliction of ill-written reports, told the Institution of Chemical Engineers how in his view reports should be written: First, explain the problem in simple language. Second, assume responsibility for all positive statements. Third, concentrate on the results that will follow the adoption of the course recommended. Fourth, say whence the data are derived on which the report is based and whether specialists in those fields agree with the data. Fifth, make a definite recommendation

one way or the other, or if that be impossible, say why. Scientists have a habit of filling much space with a nicely argued appreciation of the points for and against, of the work done in the field before and of the results achieved—often conflicting—and have done all that leaving the reader to make his choice. The result for the practical man is that he comes out by the same door as he went in. We could point to research men—but we shall rigorously deny ourselves that pleasure—who have displayed astounding energy in the prosecution of research, only to find their work pass unappreciated because they have been over-zealous in describing every experiment and observation they have made without announcing at the end any conclusion that could be put into practical effect. That, they may say, is not the purpose of a research report. If the report is written for fellow workers in the fields, that answer may be sufficient, but a paper read to a practical body such as the Institution of Gas Engineers should be written like a report to a Board of Directors. In each case the purpose is to acquaint non-specialists, practical men of affairs, with conclusions which they can use in their business.

We will take the discussion a stage further. Mr. F. A. Cobb, M.P., has lately asked in *The Times* that small firms who probably have no scientific man on their staff should join together to employ at least one qualified scientist whose duty would be to interpret research work to these firms; in Mr. Cobb's imagery, to act as the gateway to work going on in the research association of the D.S.I.R. A leading chemical paper has suggested that "if scientists attached to the research associations were to give a layman's account of their work there would be no need for these suggested group scientists. Non-scientific heads of technical firms would be able to understand and appreciate the scientist's work, the real value of which would not remain camouflaged behind scientific jargon." We shall pursue the point further in a subsequent issue, concluding for the moment by saying we feel sure that these views coincide with those of the Director of the Gas Research Board and that in the future every endeavour will be made to explain what is taking place in the research laboratory so that it can be understood and followed by those without scientific training.

RETURN TO THE FAIR

THE past year or so has been studded with events, familiar but long-missed, which betokened a return to the ways of peace. The bold announcement of an armistice gave no practical proof of a return to normality; the awakening to a realization of "peace" was gradual rather than precipitous. No resurrection of a pre-war event could be of more significance than the re-appearance of the British Industries Fair, and its return should be welcomed as an indication of peace and, we hope—in view of the export drive—a help towards prosperity. To say that its welcome was of a uniform warmth would be an exaggeration; there are some who consider the staging of such an exhibition untimely in the restricted circumstances of present-day production. We are considering in this note the Engineering and Hardware Section of the Fair at Castle Bromwich, and few are the goods that can be supplied with a delay of weeks; all too often the delay extends to many months and even years. Of what use then to set the bait for orders when the line is too weak to lift the catch? It was for this reason that a number of firms of national and international repute were conspicuous by their absence. Similarly, there are some who, against their will, felt forced to enter because another firm in the same field was exhibiting. Such an attitude is wholly understandable, but from the export point of view the B.I.F. is worthwhile and of value, not from the idea of rapid sales, but because it allows the British lion to roar, albeit guardedly, and—we are still thinking of the Birmingham Section—it serves to remind the rest of the world that eight years ago Britain's reputation as a manufacturer of engineering goods was second to none. That this ability be once more proclaimed and proved is of vital importance to our status as a nation and our future prosperity—a prosperity dependent largely on our export trade.

It may be that our eyes have been dulled with austerity years, and that we are doubly appreciative of a little colour and warmth. Be that as it may, our inspection of the exhibition at Birmingham led us to believe that it was at least as colourful and attractive as before the war. This is the second exhibition held with the intention of boosting British goods and it is interesting to note the comparison between the British Industries Fair and the earlier "Britain Can Make It." Excluding the diversity of exhibits, the presentation could hardly have been more dissimilar. At one the goods were selected by a Committee, and presented in a continuous and harmonious setting with scant attention paid to the manufacturer; the other ripples with pennants, is teeming with suave helpers, and each stand is an independent and violently self-assertive state. There are advantages to both types of presentation; the unity of one is compensated by the energy of the other.

What of the Gas Industry? Has it much to interest the visitor from overseas? The answer is unquestionably that it has. Throughout the war the research work of the Industry was, to some extent, sealed off, but the evolution and improvement of gas apparatus for industrial purposes has been both rapid and impressive. The bushel is now removed and the light made known—a light which reveals the Industry as alive, progressive, and adaptable. Apart from our friends from abroad, the architects, builders, heating and ventilating engineers, and those of the general public who visit the Fair cannot fail to be impressed by the performance, design, finish, and modernity of the gas appliances of to-day.

For the benefit of those who have been unable to visit Castle Bromwich, we publish in this issue a review of exhibits connected directly or indirectly with the Gas Industry. The review is necessarily shorter than in previous years, due to circumstances beyond our control, but we trust it is nevertheless comprehensive and of value, as a means of reference for those who have seen for themselves, and as an informative impression for those who have been less fortunate.

Paper for "Coal"

While paper remains in short supply it is not without a certain amount of jealous interest that we learn from a reply by Mr. Glenvil Hall to a question in the House of Commons that about eleven tons of paper have been put by His Majesty's Stationery Office at the disposal of the National Coal Board for the first issue of the Board's forthcoming publication "*Coal*." Asked whether he could justify the use of so much Government paper for such a purpose at a time when ordinary newspapers were severely restricted, and who was to bear the financial responsibilities for the new journal, Mr. Glenvil Hall said it would take the place of a number of house journals previously issued by companies and he took it that any loss would be met by the National Coal Board—in other words, as some members observed, the taxpayer. Supplementary questioners asked whether the replaced publications indulged in the same sort of political propaganda as the new journal would, and whether it was equitable that what was admitted to be an officially subsidized paper should compete for advertisements with ordinary commercial publications. Pointing out that many of these questions did not arise out of the question on the Order Paper, Mr. Glenvil Hall asserted that the National Coal Board was entitled to issue a monthly journal of this kind if it was so minded. "We must assume that it knows what it is doing," he added "and that it will get good value for a periodical of this kind."

Personal

The Council of the Institution of Civil Engineers has awarded the James Alfred Ewing Medal for 1946 to Sir CLIFFORD PATERSON, O.B.E., D.S.O., F.R.S., for specially meritorious contributions to the science of engineering in the field of research. Sir Clifford is in charge of the research laboratory of the General Electric Co., Ltd., Wembley. His contributions to the science of engineering in the field of research have extended over 45 years. His work has been particularly outstanding in the development of new sources of illumination, in the study of their use and in their precision measurement. This work was carried out at the National Physical Laboratory until 1919 and later continued after he had joined the General Electric Company. More recently he has co-ordinated the work of numerous teams in connexion with outstanding developments in the use of high radio frequencies, thus making possible many of the vital new weapons of defence and offence. Sir Clifford was elected a Fellow of the Royal Society in 1932 and was awarded the Faraday Medal in 1945.

Obituary

Mr. ANDREW MACKEAN, late of Coatbridge, and retired Manager of Skelmorlie and Wemyss Bay Gas Company, died at his home at Wemyss Bay, on April 27.

News in Brief

Mr. E. Shinwell, Minister of Fuel and Power, speaking at Hanley on Friday, said that after electricity, he hoped to place gas under public control at the end of the year. It was possible, however, that iron and steel might take precedence over gas.

Glasgow Corporation Gas Department, formerly affiliated to the National Gas Council and the British Commercial Gas Association, has indicated that it does not intend applying for membership of the British Gas Council, which has taken over these organizations.

The Waverley Association of Gas Managers will hold its Annual Meeting in the Y.M.C.A. Hall, South St. Andrew Street, Edinburgh, on June 27, at 10.30 a.m. Mr. James Dickson, Engineer and Manager of the Dundee Gas Department, will deliver his Presidential Address, and the meeting will be followed by a luncheon at the North British Station Hotel. Golf and bowls competitions will be played on the previous day, June 26.

Birmingham Gas Department lecturers are to visit some 50 to 60 schools, where they will give a series of talks on "Domestic Fuel Care." It is hoped that these talks, which will demonstrate to the home-makers of to-morrow many simple and effective ways in which fuel can be saved at home, will contribute to a better knowledge amongst Birmingham's rising generation of the importance of being "fuel economy minded," and a better appreciation of the wise use of fuel.

Lincoln City Council has expressed appreciation to the L.N.E.R. for special arrangements made to ensure regular transport of coal, tar, and coke during the recent adverse circumstances. Appreciation has also been expressed of the work performed by the employees of the distribution department for the splendid manner in which the gas services were restored in flooded areas. The increase in Lincoln's gas output for the past 12 months was over 180,000,000 cu.ft.

Employees of the Wolverhampton Gas Company met in the works canteen on May 10 when Mr. J. C. Neve (Chairman of the Directors), presented savings certificates, illuminated addresses and barometers to 12 employees who had recently retired, and whose combined services totalled 430 years. The Directors made a special presentation to Mr. Joseph George, who has completed 51 years with the Company. Other retirements were: Messrs. W. Palin (48 years' service), C. Lloyd (47), G. Worral (45), W. Clayton (44), J. Davies (33), T. Merrick (32), J. A. Hughes (31), R. J. Tattershall (30), S. J. Pritchard (27), and G. H. Jones (10).

At the Close of the "Britain Can Make It" Exhibition it was announced that a series of "Design Weeks" would be held in the leading industrial centres of this country. The Council of Industrial Design, in co-operation with the Federation of British Industries and the Association of Chambers of Commerce and with the full support of the Civic Authorities, has now completed the preliminary plans for these "Design Weeks." The first "Design Week" will be held in Newcastle-on-Tyne from July 7-12 inclusive. Other cities where "Design Weeks" will be held include Manchester in September, Birmingham in November, Cardiff in January, 1948, and Bradford in March, 1948. The programme for each of these "Design Weeks" will largely depend on the character of the industrial region in which it is being held and the plan put forward by the Organizing Committee. The programme will generally include conferences and meetings on industrial design; shop-window display competitions; the showing of special films; and possibly exhibitions of the work of student designers and other types of exhibitions sponsored by the organizations taking part. A feature of each "Design Week" will be a "housewives' forum," which will give housewives the opportunity of meeting a panel of experts in open forum to discuss the improvements which they may wish to secure in the design of household goods and equipment.

Ramsbottom District Council has passed a resolution expressing grave concern at the re-imposition of purchase tax on domestic gas and electrical appliances because of the serious increase in capital costs this will mean to local authorities equipping new houses. It was stated that the tax would put £2,800 on present contract prices.

The Gas Supply to Dublin households reverted on May 3 to a service of five hours a day. The periods operative are those current before the coal crisis forced a two hours' cut daily. The present times are: 6.30 a.m. to 8.30 a.m., 11.30 a.m. to 1.30 p.m., and 6 p.m. to 7 p.m. on weekdays and 7 a.m. to 9 a.m. on Sundays.

Gas was Prominently Featured in the Industries Fair at the Royal Dublin Society's Spring Show. The Alliance and Dublin Consumers' Gas Company had an attractive display of equipment, including cookers and airing cupboards, and although the present severe gas rationing in Dublin discouraged people from buying such equipment, the Company found the supply situation such that all requirements could not be met immediately. Messrs. McMulland showed Calor gas, which has been used in Ireland for 15 years. The limitation of the hours of gas supply in many places in Eire has created a greater demand for "bottled" gas. Transport is the greatest problem and immediate demands cannot always be supplied.

Diary

May 16.—London and Southern District Junior Gas Association: Annual General Business Meeting. Gas Industry House, 7 p.m.

May 19.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m.; Gas Industry House.

May 20.—Southern Association of Gas Engineers and Managers: Annual General Meeting.

May 21.—Wales and Monmouthshire Association of Gas Engineers and Managers: Annual Meeting, Engineers' Institute, Cardiff. 10.30 a.m.

May 22.—B.G.C. Domestic Development Committee 2.30 p.m. Gas Industry House.

May 22.—Southern Association of Gas Engineers and Managers (Eastern District): County Meeting, Slough and High Wycombe.

May 22-23.—Eastern Association of Gas Engineers and Managers: Spring Meeting, Chelmsford.

May 28.—Manchester and District Junior Gas Association and Yorkshire Junior Gas Association: Joint morning visit to Warrington Gas Department; afternoon visit to the works of the Richmonds Gas Stove Co., Ltd.

May 30.—Women's Gas Council: Annual General Meeting, Gas Industry House, 3 p.m. Speakers: Lady Nunburnholme, Colonel H. C. Smith, M. Milne-Watson, J. R. W. Alexander, and Miss K. M. Halpin.

June 2-5.—Institution of Gas Engineers: 84th Annual General Meeting, Birmingham. (For full programme see "JOURNAL," April 30, page 235.)

June 9.—London and Counties Coke Association: Technical Committee. 2.30 p.m., Gas Industry House.

June 10.—National Federation of Gas Coke Associations: National Technical Committee, 11.30 a.m., Gas Industry House.

June 10.—Solid Smokeless Fuels' Federation: Technical Committee, 2.45 p.m., Gas Industry House.

June 14.—London and Southern District Junior Gas Association: President's Day; Summer Visit to Portsmouth.

Midland Association President's Day at Kidderminster

OVER 100 members and friends of the Midland Association of Gas Engineers and Managers, including Mr. G. C. Pearson, President of the Institution of Gas Engineers, and Dr. Harold Hartley, Senior Vice-President, were the guests of the Chairman and Directors of the Kidderminster Gas Company on President's Day—the Spring meeting of the Association. It is a pleasant tradition of the Association that its President acts as host on such occasions, and Mr. Percy Dougall, Engineer, Manager, and Secretary of the Kidderminster Company, was well supported both by his Board and his colleagues. During the morning the visitors made a tour of inspection of the gas-works, a full description of which was given by Mr. Dougall in his Presidential Address at the Birmingham meeting of the Association on Mar. 20 ("JOURNAL," April 16, page 135).

After the inspection the visitors were entertained to luncheon at the Black Horse Hotel, at which the Rev. J. E. Grosvenor, Chairman of the Company, presided.

Historical Associations

Mr. G. C. PEARSON, President of the Institution of Gas Engineers, proposed the toast of "The Town of Kidderminster" and referred to its historical and industrial associations. It was, he said, world famous for its carpet trade, to which had been added in more recent times the manufacture of beet sugar. Its gas undertaking was well over a century old.

Alderman J. FERGUSON, Deputy-Mayor, who responded, said the town was entering upon a period of considerable industrial development. The Town Council had recently considered plans for extensions and was anxious to give every encouragement to new industries.

Mr. G. S. TOMKINSON (Director of the Kidderminster Gas Company) proposed the toast of the Midland Association of Gas Engineers and Managers, whose members, he said, had rendered outstanding service during the war. He referred especially to the setting up of the Regional Gas Engineering Advisory Board, which not only promoted efficiency through consultation between undertakings but provided machinery for mutual help in the event of enemy action. Happily Kidderminster escaped some of the worst of the raids, and only about 25 bombs and a few incendiaries fell within the Borough. The Kidderminster Gas Company counted it an honour that the Association had chosen Mr. Dougall as its President. It was a tribute to Mr. Dougall and his staff that the gas supply was never cut off for a moment throughout the war. The output had risen from 250 million cu.ft. to 360 million cu.ft. in 1945, and to 400 million cu.ft. in 1946.

Mr. P. DOUGALL, President, in reply, said that in its 69 years' history the Association had accomplished a lot of very good work, both technically and in other spheres, and it now had a little over 120 ordinary members and 14 honorary members. Reference had been made to the manner in which they had pulled through at Kidderminster; in that connexion he felt credit was due to the loyal and efficient lieutenants he had always been fortunate enough to have.

A Family Enterprise

Dr. HAROLD HARTLEY, Senior Vice-President of the Institution of Gas Engineers, proposed the toast of the Kidderminster Gas Company and referred to its remarkable family traditions. The present Board included the names of Lea, Goodwin, Grosvenor, Talbot, and Tomkinson. The name of Lea appeared in the Company's records as far back as 1833, Talbot in 1834, Grosvenor in 1849, Goodwin in 1878, and Tomkinson in 1888, and in every case the family tradition had been carried on from generation to generation. It was not surprising to find that the name of Dougall had also been associated with the Company for three quarters of a century. The Kidderminster Gas Company was typical of all that was good in the British Gas Industry and its record was one of which the Directors could well be proud. Congratulations were due to the Directors of the Company and to Mr. Dougall on their courage in proceeding with further developments while the future of the Industry was still so clouded. If and when nationalization came they would be able to hand over to the State a well managed and controlled undertaking.

The CHAIRMAN, in his reply, alluded to his clerical collar and said he had recently had the honour of being appointed Chairman of the Company, actually just before his ordination. He did not see any reason why the two distinctions should be incompatible. He had been elected to succeed their greatly lamented Chairman, Sir Sidney Lea, who was elected Chairman 24 years ago on the death of his (Mr. Grosvenor's) father, who, in turn, had been elected 21 years earlier on the death of Sir Sidney Lea's grandfather. All the members of the present Board were members of directorial families who had had representatives on the Board for many years, almost from the beginning of the Company. The only present Director who was not the son of a former Director was, in fact, the grandson of one.

In going round the works one of the visitors had commented that their vertical retorts were out of date. Had they paid their visit 18 years ago or deferred it until four or five years hence his impression might have been different. Progress was such that what was modern to-day was out of date to-morrow, but he could assure them that they had some really beautiful vertical retorts on order. Like others in the Gas Industry, however, they felt the stultifying effect of the shadow of nationalization. It was very difficult to keep everything up to date when they felt in the position of those gentlemen in the arena of olden days who used to say "We, about to die, salute you, O Cæsar." They felt they were about to be slain and that they would possibly not see the effect of what they were doing. He could not help thinking that the country was losing a great deal of initiative to-day because of the threat of nationalization. He could not say whether nationalization, of itself, was good or bad. It was a matter about which they could all argue, but it seemed to him that it was a mistake to be bothering about it just now when they ought to be more concerned with getting the country into the highest possible state of efficiency.

The Price of Gas

Gas was one of the few things to-day which was not costing the consumer double the price prevailing eight years ago. They could take credit at Kidderminster for the fact that they had not raised the price of gas since 1940, and there were very few commodities not subsidized by the Government which had remained at 1940 levels. He could not say how long they would continue to be able to sell gas at the present price, and it might be unfair to point a finger of scorn at the controllers of a nationalized Gas Industry three or four years hence and accuse them of doing something which in any event might become inevitable.

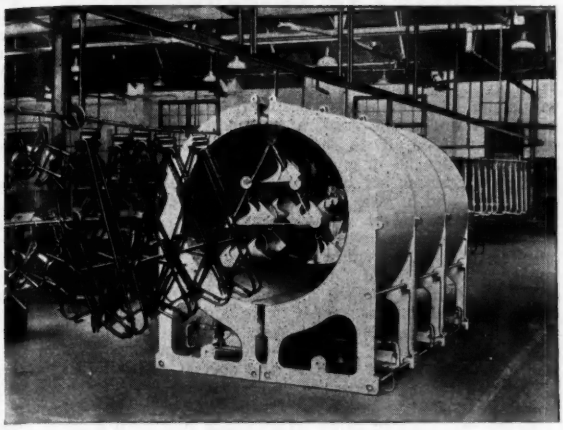
Councillor J. E. TALBOT (Director) proposed the toast of "Our Guests" and referred to the presence of the Deputy Mayor, the Chairman of the Kidderminster Rural District Council, officials of the Borough and Rural District, and representatives of the Ministry of Fuel and Power. The Company, he said, was proud of its family tradition and its personal touch, and he feared the public were in danger of losing something which no bureaucratic nationalization could ever hope to provide. At the same time he paid warm tribute to the great assistance they had received from the Officials of the Ministry of Fuel and Power. It was one of the finest traditions of our Civil Service, he said, that no matter what were the fads of the particular party that happened to be in power they always tried to make the machine work, and whatever the future might bring he was confident that they could look forward to that same tradition.

Alderman H. W. CHESHIRE, an ex-Mayor of Kidderminster and now Chairman of the Kidderminster District Education Committee, briefly replied on behalf of all the guests. The Kidderminster Gas Company, he said, had always been noted for its helpfulness and sympathy towards consumers. It had a long history and had played a big part in the life of the Borough, and he hoped it would long continue to be administered by the present Board.

After lunch the company divided into two parties, one visiting the carpet works of Tomkinsons, Ltd., and the other those of Carpet Trades, Ltd. Although gas does not play an important part in carpet manufacture, the visit to the heart of Kidderminster's staple industry was of absorbing interest. In each case the guests were afterwards entertained to tea.

Airdrie Gas Department has received Ministerial consent for the extension of its high pressure distribution system involving the laying of new high pressure mains and the converting of an existing low pressure main to high pressure. This scheme is designed to supply the increasing load in the eastern part of the district, which extends to a distance of five miles from the gas-works. The Ministry have also approved of a trunk main extension in the northern part of the area, where a connexion will shortly be made to a bakery requiring an additional 5,000 cu.ft. per hour. The output of gas has doubled since the outbreak of war and the works plant is being increased and modernized. The retort capacity is now being doubled, new condensing, detarring, and washing plant are being installed, and an order has been placed for a waste heat boiler to raise steam from the blow gases of the carburetted water gas plant.

Infra-Red at Southport



Part of a Parkinson and Cowan gas infra-red tunnel installation at the Brockhouse Engineering Company's works, Southport. Our photograph shows the stoving of frames, mudguards, &c., of the Corgi miniature motor cycle, of the type similar to that used by paratroopers during the war. Time taken varies from 1½ minutes for the mudguards to 12 minutes for the framework.

Birmingham Appointments

Changes have been made in the composition of the Industrial Research Laboratories Group of the Birmingham Gas Department. The old name, well known since 1916, now disappears and the staff and workmen are divided into two entirely separate sections of the Gas Department, the one section to be called the Physical Testing Laboratory, and the other to be known as the Industrial Department. The former will continue its work of physical testing and inspection of all kinds of ferrous and non-ferrous metals, building materials, &c., while the latter, as its name implies, undertakes the work of the development and maintenance of the industrial gas load in Birmingham and indeed other parts of the country through the British Gas Council Centres Scheme. The Heat Treatment Section becomes a part of the Industrial Department and continues its work on heat treatment of metals, tools, component parts, &c., for the manufacturer generally. Mr. V. E. Green becomes Engineer of the Physical Testing Laboratory, with Mr. L. F. Short as Chief Technical Assistant; Mr. H. R. Hems as Manager of the Industrial Department, with Mr. L. D. Creedy continuing as Superintendent of the Heat Treatment Service, and Mr. J. F. Waight as Superintendent of the Development and Installation Service. The Chemical Laboratory and Appliance Test Room, with most of the staff formerly under the supervision of its Senior Chemist, Mr. G. R. Simpson, has been transferred to the Central Laboratory, Nechells Works, under the control of the Chief Chemist.

Gas for Trading Estates

Work has been started by the United Kingdom Gas Corporation on an important £110,000 scheme at Dowlais, South Wales, to produce town gas for use by the new factories that are being erected on the two Government sponsored trading estates at Cyfarthfa and Pentrebach, near Merthyr Tydfil.

The scheme involves converting to town gas production a large blue water gas plant at the Dowlais fat-hardening works operated by Unilever Ltd., for the Ministry of Food during the war, and laying four miles of underground gas mains from Dowlais to the Merthyr gas-works and thence to the two estates. Mains are also to be laid from Dowlais to the Bargoed supply station of the Rhymney and Aber Gas Company seven miles away to augment the supplies of coke oven gas in the area served by that Company.

Two million cu. ft. of gas a day will be produced from coke and oil by the converted plant and will be pumped under pressure to supply the heating requirements of the new factories.

This is the fourth development project launched since the war by the U.K. Gas Corporation, the £6,000,000 group which controls 75 supply undertakings. Recently approval was given by the Ministry of Fuel and Power to a £1,250,000 scheme planned by the Corporation for supplying gas fuel to industries in the West Riding of Yorkshire.

W.G.C. at Cheltenham

The encouragement of a more efficient and careful use of gas was a mission which could be undertaken for the community by the Women's Gas Council, said the Mayor of Cheltenham (Coun. H. T. Bush) at the first meeting of the Cheltenham and District Branch of the Women's Gas Council. The branch, which was inaugurated with a four-day "Gas in the Home" display at the Gas Offices, Cheltenham, was officially opened by the Mayor. Extending his best wishes for a successful career, the Mayor said that one of the objects of the Council which most appealed to him was that it would provide a channel through which the housewife could place her views before the proper authorities.

A luncheon before the opening was attended by officials and members of the staff of the Gas Company, and members of the inaugural committee of the Cheltenham Branch of the Women's Gas Council. Among those who attended were the Mayor, Mr. John Marshall (Director), Lady Boyce (Chairman of the Inaugural Committee), Mr. A. L. Morris (General Manager) and Mrs. Morris, Mr. G. M. Gill (Consulting Engineer of the Severn Valley Gas Corporation) and Mrs. Gill, Miss D. W. Pidsley, Mr. M. R. Webb, Mr. and Mrs. A. G. Holtam, Miss E. Eldod, Mr. S. Vernon, Mrs. Bruce George, Miss Marshall, Mr. and Mrs. C. R. Ingham, Mrs. A. Pears, Miss M. Hampson, Mrs. Tevendale, and Miss G. M. Dawson Caves. Among those who attended the official opening were Mrs. D. L. Lipson and Mrs. W. W. Hicks Beach.

A welcome on behalf of the Gas Company was extended to those present by Mr. A. L. Morris and by Lady Boyce, to whom a bouquet of roses was presented by Miss Sylvia Walker.

Miss D. W. Pidsley, Assistant Secretary of the Women's Gas Council, said the Council's aims were to help women to use gas to the best advantage and to assist in running the home through the dissemination of homecraft knowledge.

The opening ceremony was followed by two films. Supporting the inaugural meetings was a series of displays by manufacturers of domestic appliances.

Key to Conversion

We were pleased to be present on Friday last at a reception, on the invitation of Ascot Gas Water Heaters, Ltd., the purpose of which was to call responsible attention to a new book which the firm has issued, entitled "Houses into Flats." This publication, designed for the use of architects, housing directors, and members of local authority housing committees, is remarkable in its presentation and its contents and will, we feel sure, be helpful to the Gas Industry. The theme of the book is the conversion of large town houses into flats, the while maintaining architectural tradition which add prestige not only to certain parts of the great Metropolis, but also to other famous cities and towns in Great Britain. Conversion of the type would appear inevitable under current and likely scales of taxation; and the basic aim of this latest Ascot publication is to explain through authoritative source and guidance how best to achieve this conversion in the common cause of the community in general, and how, in this conversion scheme, gas can help.

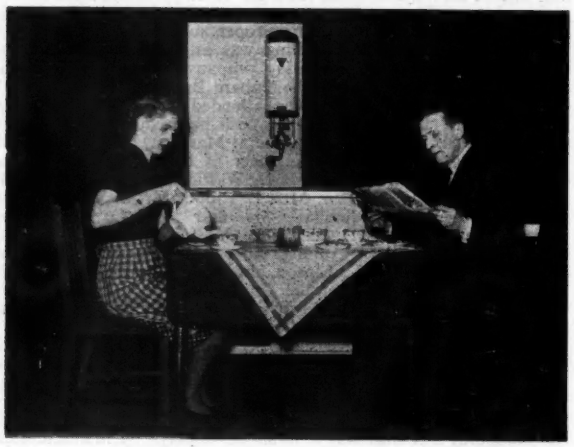
In the book, distinguished by its notable contributors, Mr. Frank Yerbury, Director of the Building Centre, contributes an Introduction and has, we gather, been generally responsible for the framework of the publication. The Earl of Limerick, Chairman of the Ascot Company, puts the case for conversion in a brief Foreword. "New construction alone," he writes, "cannot meet our needs. In these circumstances, not only must the best use be made of available materials, skill, and labour in all building work, but also imagination and resource must be brought to bear to the greatest extent in converting for occupation all accommodation that can be made available."

Speaking to the guests assembled last Friday, Lord Limerick said that his Company was responsible for producing a very large quantity of instantaneous gas water heaters and that the Company's aim was, through unremitting research and practical application of this research, to market appliances of first-class quality. "We are," he said, "proud of our products and believe they make a useful contribution towards creating some of the amenities of life in large number of homes." Among relative problems, he added, was the pressing housing problem, involving four million new dwellings. He expressed the hope that in this regard, the new Ascot book would in some measure help towards a solution of the problem. Lord Limerick then introduced to those present Sir Launcelot Keay, K.B.E., President of the Royal Institute of British Architects, who said how much pleasure it gave him to launch the publication "Houses into Flats," for though he realized that temporarily it must sail in troublous waters, all who put their faith in what he termed the "ship," could be confident of a safe passage.

Sir Percy Thomas, O.B.E., Past-President of the R.I.B.A., added congratulatory comments not only on the book itself, but on the fundamental idea of the service envisaged.

"Breakfast for Two"

A short comedy entitled "Breakfast for Two," featuring the Ascot Boiling Water Heater, is being produced in the Dorland Hall Theatre during the run of the *Daily Herald* Modern Homes Exhibition. The script was written in the advertising department of Ascot Gas Water Heaters, Ltd., and briefly tells the story of Harriet and Richard who have just purchased an Ascot Boiling Water Heater with a subsequent saving in time when tea and boiled eggs are on the board.

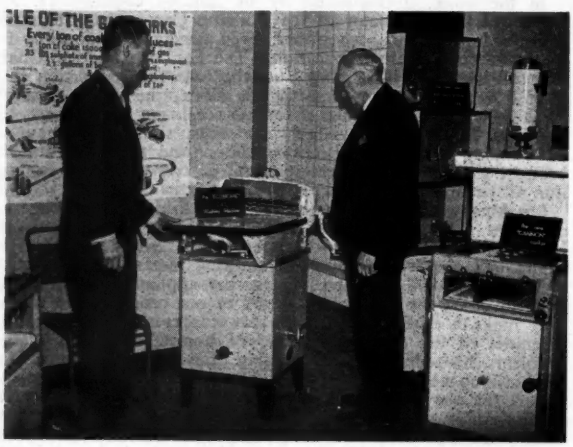


The comedy is one of a short series of scenes and playlets which are featured daily at the exhibition, all of which are produced by Mr. Eric Spear, of B.B.C. fame, the two artistes being Pam van der Beeck and Geoffrey Denton. The Exhibition, which is to continue until May 24, carries very good gas representation and Ascot Heaters are well represented by the Boiling Water Heater on the stage, another on the B. G. C. stand of gas appliances, a Multi-point in a "converted kitchen" designed by Mrs. Darcy Braddell, and a Sink Heater forming part of the furnishing of a "Flat in two Rooms" the contents of which is the first prize in a special competition organized for visitors by the *Daily Herald*.

Exhibition at Sheffield

The Lord Mayor of Sheffield, Councillor E. S. Graham, recently opened an exhibition organized by the Ministry of Fuel and Power at the Attercliffe Wesleyan Hall, Sheffield.

The accent is on Coal, and what it does, and the main purpose of the exhibition is to attract labour to the mines by emphasizing the valuable part which coal mining plays in modern industry.



The Lord Mayor of Sheffield, Councillor E. S. Graham, inspecting gas appliances after opening the exhibition.

The Sheffield and District Gas Company's display shows the process of the manufacture of gas, and the extraction of by-products, in pictorial form, and also includes a representative selection of the latest type of gas appliances. Gas Industry films are being shown each day.

World's First Engineering Centre

The world's first Engineering Centre to be opened in Glasgow in September with the approval of the Institution of Gas Engineers and some 40 other Associations, was described by Major Gordon Jackson, Managing Director of the Engineering Centre, Ltd., Glasgow, when he spoke at the luncheon meeting of the Publicity Club of Glasgow on April 25. He said the Centre would be a permanent exposition of materials, methods and machinery under one roof, a comprehensive engineering service offering unbiased advice and functioning to facilitate co-operation among all engaged in engineering.

The programme set by the Directors was comprehensive and ambitious, and it was the aim to make these buildings in Sauchiehall Street the cultural centre for British engineering. There had been an excellent response, one national association offering to take the entire space in their section. But this was not what was wanted. The Centre preferred a multiplicity of firms and had established a limit of £500 space for firms and £1,000 for associations. They were aiming at between 300 and 400 firms spending £100 per year, which sum would give continuous display space. The various developments in technology would be studied and displays and special exhibitions organised to get the results across to interested buyers. Salesmanship would be barred.

Nearly 90% of the firms taking space had been English firms, but steps had been taken to restore the balance and many Scottish firms were now taking space. The Centre had acquired the former Cooper and Co. block in Sauchiehall Street, and would extend to the remaining four shops and storeys, giving adequate space for expansion. When the Centre opened, the sponsors would have laid out £250,000 on the project.

Watford Housing

The Rt. Hon. Lewis Silkin, Minister of Town and Country Planning, accompanied by the Mayor and Mayoress of Watford and Councillor J. S. P. Davey, Chairman of the Housing Committee, inspect the stand of the Watford and St. Albans Gas Company during the recent Housing Exhibition at Watford Town Hall.

Negotiations between a joint sub-committee of the Mansfield and Chesterfield Corporations and the Ministry of Fuel and Power for additional coke ovens to be erected at Grassmoor and Hardwick Collieries to afford increased gas supplies to the two towns, have been held up by a refusal of the Ministry to approve the scheme. Pending further negotiations with the Ministry, it is hoped to carry out a short-term policy to augment the existing supplies before next winter.

Mr. A. R. Bisset, Engineer and Manager of the Douglas Gas Light Company, is the inventor of a device known as the Bi-Set pipe cleaner for use with horizontal retort installations. Instead of augering, the pipe cleaner is dropped down the ascension pipe and drawn back again to a "position of rest" at the top of the pipe at any time during the process of carbonization, being brought into operation twice per shift. The principle of gravity ensures that the pipe cleaner descends the full length of the ascension pipe, its circular knife cutting away any carbon deposit during its downward passage. The device is manufactured by Messrs. Drakes, Ltd., of Halifax.

New High Pressure Storage Inaugurated at Leeds

Leeds Corporation Gas Department's new high pressure storage station at Fir Tree Lane, Moortown, Leeds, was officially opened on April 24 by the Lord Mayor of Leeds, Councillor, Sir George Martin, K.B.E., J.P., when he unveiled a tablet to commemorate the occasion.

The new plant, which is situated in a residential area on the outskirts of the City, is almost completely screened from view by trees, and is barely visible from the main Leeds-Harrogate road which runs close by. The high pressure storage tanks are sunk into the ground, and being painted a dull green blend with the natural beauty of the surroundings.

Capable of storing 500,000 cu.ft. of gas, this new station is part of a plan to supply suburban areas in Leeds, and when completed will be one of the largest in the country, with a capacity of 1,000,000 cu.ft. The plant is entirely automatic, subject only to inspection by a maintenance engineer. Leeds Gas Department already have a similar station at Bramhope and others are being erected at Beckett Park and Cookridge.

Following the inauguration ceremony and inspection of the plant, a luncheon was held in the Queen's Hotel, Leeds, at the invitation of the Bryan Donkin Co., Ltd., and Clayton, Son & Co., Ltd., Contractors for the plant.

Moortown Plant

The compressing plant is in duplicate. Each machine is a vertical two-crank, double acting, two stage reciprocating compressor. Each machine will pass 42,000 cu.ft. of free gas per hour at 55 lb. per sq.in. pressure when running at 485 R.P.M. Intercoolers are fitted between the first and second stage on each plant. The drive is by 100 B.H.P. electric motors fixed in a separate room and connected direct to the compressors by extended shafts with wall-sealed glands. All the electrical equipment is fixed in the motor house. The starters have a three-position switch—Hand, Automatic, and Off. The compressors are fitted with hand-controlled unloading gear, so that either set can be run light.

Gas is supplied to the district from the receivers by 14 in. Reynolds district governors, in duplicate, operating at inlet pressure of 1-55 lb. per sq.in. and outlet pressure of 3 in. to 6 in. w.g. The whole station is entirely automatic.

The operation of the plant is controlled by three main factors: (1) Time; (2) the gas conditions in the low pressure mains; (3) the gas conditions in the receivers.

A selector switch chooses No. 1 plant as starter and No. 2 plant as stand-by or *vice versa*.

Each plant is equipped with its own set of automatic devices which consist of: (a) High pressure relay switch; (b) low pressure relay switch; (c) time switch; (d) pilot unloader; (e) thermostat switch.

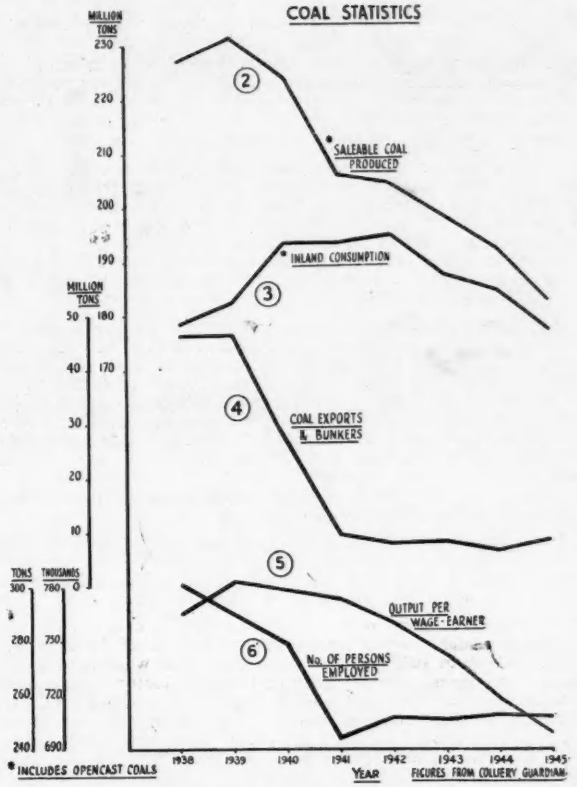
The time switch is set for midnight to 6 a.m. (or any other time) and the low pressure switch at 25/10 in. w.g. (or any other pressure). When the time switch closes, then, provided the gas in the low pressure main is more than 25/10 in. w.g. and the pressure in the receivers is less than 30 lb. per sq.in., No. 1 starter will be put on the line. The starter immediately energizes the pilot valve which unloads No. 1 compressor and closes the high pressure station governor. The compressor runs up to speed on no load, the pilot valve becomes de-energized, and the plant is then on load. Cooling water is supplied to the gas cylinders and intercoolers by centrifugal pumps driven from the compressors, drawing water from six water tanks. The plant continues to run until either: (a) The receivers reach 55 lb. per sq.in.; (b) the low pressure gas supply drops below 25/10 in. w.g.; (c) the time switch opens.

A thermostat switch would stop the plant in the event of the cylinder temperature reaching a pre-determined maximum. The plant would also stop in the event of the motor going on single phasing. If for any reason No. 1 plant failed to start up, then No. 2 would come into service after a time lag of 20 seconds, following the same procedure. A red lamp would be lit indicating that No. 1 plant had failed to run, and that No. 2 plant had done the work.

The installation stores 500,000 cu.ft. of free gas contained in three receivers of riveted construction. Each receiver is 24 ft. inside diameter by 107 ft. inside length, constructed of Siemens Martin boiler-quality steel and weighs 150 tons. The working gas pressure is 55 lb. per sq.in. Each receiver is supported on eight cradles, anchored at the front end cradle, resting on rollers on the remainder and is thus free to move, allowing for expansion. The receivers are bridged by a common platform reached by steel ladders from ground level, and entry into each is by internal steel ladders from a manhole adjacent to the platform. Each receiver is equipped with safety valves, pressure gauge, thermometer, and drain cock.

Manpower and Coal Production

In last week's "JOURNAL," p. 281, we reproduced a graph showing the quantity of coal produced and wages paid per shift per man during the years 1914-1946. We publish to-day further interesting graphs on the subject, and again we are indebted to the Severn Valley Gas Corporation, Ltd., for the accompanying diagrams, which were prepared by Mr. G. M. Gill.



In Graph 2 the saleable coal produced during the war has shown a marked reduction from 227 million tons in 1938 to 183 million tons in 1945. As a direct consequence we have lost our export trade and do not produce enough for our own requirements, though this latter would have been clearer had the figures for 1946 been included. We see from Graph 3 that inland coal consumption rose and then fell during the war. Fuel economy was developed and practised in a big way during the war, while Single and Double Summer Time was used to the maximum extent from 1942 onwards. In Graph 4 is indicated the complete loss of our coal export trade, while Graph 5 indicates the output of coal per wage earner. As will be seen, it decreased from 302 tons in 1939 to 246 tons in 1945. In Graph 6 are shown the number of persons employed in and around the mines. It fell sharply until 1941 and then showed some increase, in spite of which the coal produced continued to fall.

Belfast Corporation has withdrawn its opposition to the Northern Ireland Bill on the condition that the Government of Northern Ireland will not seek to acquire the Corporation's electricity, gas, or transport undertakings, unless by agreement. At first the Bill provided for compulsory acquisition of public undertakings. The Prime Minister of Northern Ireland (Sir Basil Brooke) has given an undertaking to this effect to the Lord Mayor (who was opposing it in Parliament) and the Corporation.

Stornoway Town Council is holding the Stornoway Gas Light Company responsible for loss and damage caused by putting tar into the burgh sewer. Councillor Bain said it appeared that when a 9 in. pipe belonging to the gas-works choked with tar, the Company made no attempt to clear it, but took the easy way out and put the stuff into the town sewer. The Council agreed to write to the Gas Company telling them that they must stop putting tar into the sewer. There was a division of opinion, however, on a further recommendation by the Public Health Committee, to claim against the Gas Company for the expense in which the Council were involved. Following a vote it was decided to claim against the Company.

Manchester District Association of Gas Engineers

Presidential Address*

of

T. R. COOK, M.Inst.Gas E.,

Gas Engineer and Manager, County Borough of Blackpool

IN submitting my Presidential Address I desire firstly to thank you and to express my sincere appreciation of the honour conferred upon me in electing me President of the Association for the coming year. You may be assured that I shall use my best endeavours to uphold the high tradition of the office you have entrusted to me.

It would appear that nationalization of the Gas Industry will not be long delayed and it is possible that many changes will take place in the not too distant future. Whatever is before us let us try to strengthen the ties and bonds of friendship in our Association, always endeavouring to appreciate the variable viewpoints held by brother gas engineers in so many matters affecting the Industry we serve, and may we continue with that mutual aid and assistance to each other to the utmost limit in the future.

I have been in charge of the Blackpool Corporation Gas Department for the past 16 years, and having had the experience of selecting a new site on the borough boundary well away from the centre of the town and that of directing the building of a complete new gas-works on the site, I thought there might be some points in the design and subsequent working of this plant which would be of interest to you. These notes will be to some extent supplementary to the Paper submitted to the Institution of Gas Engineers in 1940, which unfortunately owing to war conditions missed that open discussion and criticism which it will be agreed are always helpful in the general advance of the science and art of gas manufacture.

No works will be perfect, and such varying conditions as those by which the Industry has been beset in the past six years, and the improvements which are continually being made in carbonizing and ancillary plant, make any works almost out-dated within the space of a few years.

Alterations in the type of coal available affect the output of the gas plant laid down. Changes in railway demurrage charges and increased fluctuations in coal supplies alter the requirements for stocking and reclaiming coal. These and other factors would have had a decisive influence on the capacity and layout of plant if we had been able to foresee the effects of the changes which were to come about within the comparatively short period since the works was put into commission.

Siting of Gas-Works

The aerial photographs reproduced here show the old Princess Street Works in an extremely congested area of the town and close to the Promenade (Fig. 1), and also the new Marton Works (Fig. 2), which are situated some three miles from the centre of the town in an undeveloped country district.

FIG. 1.—*The Princess Street Works of the Blackpool Corporation Gas Department*

It was fully realized when the site was chosen that it was highly possible that building developments would take place in the future in the area surrounding the works, and having this feature in mind the works have been designed well set back from the roadway to remove

FIG. 2.—*The Marton Gas-works, Blackpool*

as far as possible some of the objectionable features of gas making plants.

The continuous vertical retort house and other principal buildings have been built on lines which comply with the best architectural lines in industrial structures, and the works will be screened as far as possible by means of belts of trees to reduce to the minimum any disaffection of the area. The material chosen for the construction of the buildings was Accrington Nori Engineering brick so that the buildings should retain a good surface appearance during their useful life.

Completion of the Works and Subsequent Developments

I am greatly indebted to Messrs. West's Gas Improvement Co., Ltd., for their design and construction of the retort house and coke plant and I should like to take this opportunity of congratulating them on a fine achievement—a distinct advance in the architecture of gas-works plant.

The Paper presented to the Institution of Gas Engineers (Communication No. 230/95) contains a full description of the works and I do not intend to go over this ground again, but the subsequent developments after the completion of the works may be of more than passing interest.

It was fortunate indeed, that the Marton Works was completed and put into operation in July, 1940. The old works at Princess Street was scheduled for demolition and gasmaking was shut down. The weekly output of gas in 1939 and 1940, showed a marked reduction in demand in the early months of the war due to the exodus of visitors from the town. But it was even more fortunate that my Committee agreed that it was advisable, in spite of the surplus plant apparently available, to repair some of the plant at the Princess Street Works in 1940.

The view then taken by the Committee was that it would be advisable to have separate plant available as some insurance against the possible effect of air raids upon the town. We were perhaps wiser than we knew, for from 1941 onwards Blackpool experienced a great influx of temporary population. Many thousands of evacuees from bombed cities and towns sought refuge in Blackpool, hotels were occupied by Government Departments, other premises were arranged as training centres for Army and Air Force units, men and women, and the vast

* Presented at the 77th Annual Meeting at Manchester, May 9.

majority of the 10,000 boarding houses in the town were used for billeting purposes. Over 450,000 R.A.F. personnel received their preliminary training in Blackpool and in 1940 over 47,000 men were billeted in the town. Nor did industrial gas escape this rapid inflation, for a large aircraft factory and a number of subsidiary factories were built in the town producing no less than 3,406 bombers during the war period, and requiring as much as 100 million cu.ft. of gas per annum in the processes of manufacture.

There is still a summer peak but the maximum peak load now falls in the winter months. But more significant is the filling in of the steep valleys which before the war were characteristic of this undertaking. With their disappearance went the usual opportunities for inspection and repairs to refractory materials and other parts of the plant.

The timely repair of, and resumption of manufacture at, the old Princess Street Works saved the situation and enabled us to maintain full supplies at full pressure throughout the whole of the war period and to meet an increased demand of 500 million cu.ft. per annum over that of 1939 without recourse to further capital expenditure.

Extensions to Marton Works, Blackpool

As the output of gas is still increasing due to the shortage of coal for domestic consumption, coupled with the heavy influx of visitors to the town, due in some measure to the policy of holidays with pay, it has been essential to proceed with new plant at the Marton Works. A schedule of plant together with the approximate cost is submitted for your information, which shows the magnitude of this work.

Schedule of Plant to be Erected at Marton Gas-Works 1946-49

Item	Description of plant.	Estimated time of completion	Approximate cost £
1	Complete new setting of 8 Glover-West vertical retorts. Nominal capacity 720,000 cu.ft./diem	April, 1947	17,400
2	One cast-iron water cooled condenser, horizontal tubes. Capacity 4 million cu.ft./diem	April, 1947	5,967
3	Two complete fully automatic sets of Humphrey & Glasgow, Ltd., carburetted water gas plant, together with W/H boilers, self-clinkering grates, two condensers, coolers, &c., coke conveying plant to be erected in existing building prepared in 1940. Each set capacity 3 million cu.ft. of gas per day, 450 B.Th.U.	1947	76,680
4	One electro-static detarrer on coal gas stream. Capacity 8 million cu.ft. per day	1946	7,631
5	One electro-static detarrer on C.W.G. stream. Capacity 4 million cu.ft. per day	1947	1,556
6	One spiral guided gasholder, 250,000 cu.ft. capacity. Water gas relief holder ..	1947	17,470
7	Transference of Livesey washer (4 million cu.ft. per day capacity) from Princess Street Works	1947	350
8	New static ammonia washer, W. C. Holmes & Co., Ltd., 4 million cu.ft. per day	1946	2,360
9	Transference of 4 purifier boxes, 35 ft. × 30 ft. × 6 ft., from Princess Street Works	1947	10,500
10	Installation of new purifiers, 5 boxes 50 ft. × 45 ft. × 6 ft., complete with revivifying floor and foundations ..	1948	58,800
11	Erection of new spiral guided gasholder, 5 million cu.ft. capacity	1949	143,000
12	Steam-driven turbine booster, Bryan Donkin, 1 million cu.ft. per hour capacity at 60 inches W.G.	1947	3,994
13	Installation of Connersville exhauster, 7 million cu.ft. per day capacity ..	1947	3,065
14	Three compressors, 250,000 cu.ft. per hour each, at 20 lb. initial pressure ..	1948	13,100
15	18 in., 15 in., 12 in. diameter high pressure mains and governors, new high pressure mains system from Marton Works to the town	1948	31,494
			£393,367

The total cost of the Marton Works up to the year ended March, 1946, and as described in my Institution Paper, was £441,000. The outstanding capital debt of the undertaking at that date was £445,000, equivalent to £232 per million cu.ft. of gas sold. It is anticipated that when the Princess Street Works can be closed down the economies which will be effected will go far towards meeting the additional capital charges on the undertaking. Higher efficiencies and more effective control should certainly be secured by the concentration of manufacturing plant at one works. It is estimated that the total outstanding debt in 1949 will be in the region of £750,000 with gas sales approximately 2,350 million cu.ft. per annum, equivalent to £319 per million.

This is a serious increase. The rocketing costs of gasmaking plant together with the increasing costs of maintenance and operation are matters which must be causing anxiety to most gas engineers. In particular the different relative costs of the several types of plant may give rise to a revision of hitherto accepted practice. For instance, the present capital cost of the modern automatic carburetted water gas plant with mechanical coke handling plant, as compared with the cost of a complete installation of coal carbonizing plant with coke screening plant, is such that careful consideration should be given to the overall costs of the two gasmaking processes. If in the future there is still a deficiency in the supply of gas coals, engineers may well give consideration to a combination in different proportions of the two processes, irrespective of the demand for coke.

It will doubtless be agreed that in high temperature carbonization, and as long as the temperature of the waste gases can be effectively used for steam raising purposes, this heat should be utilized. Before deciding on the electrical generating plant required, the steam and the electrical requirements of a works should be carefully extracted if the highest efficiencies from the plant are to be attained. Particular regard should be given to the relative merits of the " back pressure " or " pass out " type of steam engine required to obtain the best balance.

When considering the supply of electricity to the Marton Works it was calculated that all steam requirements except peak loads would be available from waste heat, utilizing back pressure steam from the generator engines at 25 lb. per square inch for process work. It was estimated that if breeze was used in the dri-back boilers, the price debited to steam raising costs would not exceed 5s. per ton and the cost of generating electricity would not exceed 0.25d. per unit.

On a gas-works it would appear to be inadvisable to be entirely dependent on electricity supplies from the grid, as a breakdown in supplies might jeopardize the supply of gas to the town. When electricity supplies from the grid are normal, it would not appear to be an economical proposition to install expensive and extensive electrical generating plant if steam has to be generated by solid fuel for this purpose, particularly if electricity can be purchased in the region of 0.75d. to 1d. per unit. Changes in fuel costs will obviously alter the best of plans, and I need not stress this point, as we are all aware of the position of the market and the variable prices received for fine and rough breeze during the years 1939-1947.

Coke Screening Plant

The cost of this plant has been more than justified. Good storage accommodation above ground has proved a good investment, even apart from labour saving. The various sizes of coke are debreezed into the bunkers and the fuel is again debreezed before bagging or loading into carts, lorries, or railway wagons. On an average the moisture content of the coke has been 1.5% to 2.0% and the coke has been free burning and of open texture—an excellent fuel for the domestic hearth.

The screens have given little trouble and are easy to maintain. Apart from the renewals of screen mesh, little attention is necessary except an occasional greasing of the bearings.

Maintenance Costs

A glance at the maintenance cost of the retort house and coke plant over the six-year period may be of interest.

Total coal carbonized	476,535 tons
Total coke screened	246,383 „
Total coke made (approx.)	285,904 „

	Total	Cost per ton of coal carbonized	Cost per ton of material handled
	£	s. d.	s. d.
Retort settings	28,240	1 2.22	—
Extractor gear	863	0.43	—
Coal handling—			
Weighbridge, wagon-tippler and breaker	1,131	0.57	—
Gravity (lipped) bucket conveyors	4,969	2.51	1.56
Band conveyors	653	0.32	0.33
Coke handling—			
Band conveyors	2,846	1.43	0.28
Screens and intermediate conveyors	1,979	1.01	1.92
Producer and retort Skips ..	489	0.25	—
Ash handling	1,433	0.71	3 11.30
Electrical equipment	5,966	3.01	—
Boilers—			
Solid fuel	5,046	2.52	—
Waste heat	5,129	2.59	—

Coke Production

As the method of calculating the fuel expenditure index figure does not take into account the moisture in coke, the undertaking is at a great disadvantage when making comparisons with other undertakings' results, since it will be appreciated that a moisture content of 1.5% or 2.0% in coke as against 6% to 10% means a considerable reduction in the total weight of coke sold. I am, nevertheless, still an adherent to the policy of the sale of coke with the lowest possible moisture content and a fuel free from breeze and dust, and maintain that far greater satisfaction can be obtained from the use of clean, dry coke in the open grate.

It is hoped that the Ministry of Fuel and Power at some time in the future will allow increased prices to be charged for coke with higher carbon content, if coke prices are to remain controlled and freedom of action is not allowed. This would be an incentive for works to pay more attention to screening and to the moisture content of coke.

Owing to the heavy demand for coke during the past six years there has only been one occasion when we were able to put down some 3,000 tons on the stocking ground. The 1,000 tons capacity bunker has always taken care of our normal stocks of coke, which only accumulated over very short periods. This feature has reduced the labour of handling coke to a minimum ; the maximum number of gas-works employees employed on the plant has never exceeded five men, including shift workers. Larger overhead storage hoppers in the future would probably be erected at most works, and it would appear that a fairly heavy capital expenditure is justified on this section of the works plant.

Working Results, 1940-46

The appended working results for 1939-1946 show that the output of gas has increased by some 30% over the year 1939, and that in 1946 the undertaking had 44,268 consumers with gas sales at 1,893,157,000. cu.ft. The total gas made for the year ended March 31, 1947, and the estimated total sales have been 2,332,640,000 cu.ft. and 2,169,360,000 cu.ft. respectively which is a record for the undertaking

County Borough of Blackpool—Gas Department

Summary of Results of Working, 1939-46

Year ended March 31, Details	1940	1941	1942	1943	1944	1945	1946
Coal carbonized ...	78,957 tons	89,713 tons	107,351 tons	112,610 tons	112,500 tons	122,000 tons	120,420 tons
Price of coal	£1 6s. 11.5d. ton	£1 10s. 2.11d. ton	£1 17s. 3d. ton	£1 17s. 4.96d. ton	£1 18s. 8.67d. ton	£2 4s. 5.02d. ton	£2 8s. 11.67d. ton
	cu.ft.	cu.ft.	cu.ft.	cu.ft.	cu.ft.	cu.ft.	cu.ft.
Make of gas	1,490,000,000	1,640,000,000	1,950,000,000	1,930,000,000	1,970,000,000	2,100,000,000	2,044,148,000
Sales of gas	1,360,000,000	1,500,000,000	1,800,000,000	1,810,000,000	1,825,000,000	1,950,000,000	1,893,157,600
Prepayment	430,000,000	457,000,000	521,683,000	520,000,000	517,513,000	539,937,000	544,423,200
Ordinary...	856,899,000	993,000,000	1,192,612,000	1,209,335,000	1,223,723,000	1,284,000,000	1,240,502,300
No. of consumers ...	43,742	43,985	43,925	43,971	44,126	44,069	44,268
Average price of gas ...	2s. 8.31d.	2s. 11.51d.	2s. 10.99d.	2s. 11.59d.	3s. 2.326d.	3s. 3.509d.	3s. 7.648d.
Sale of coke (including breeze)...	23,107 tons	30,485 tons	38,850 tons	40,821 tons	43,978 tons	48,959 tons	45,671 tons
Sale of tar	6,564 tons	7,405 tons	9,574 tons	10,053 tons	10,129 tons	9,559 tons	9,578 tons
Sale of benzole from Marton Gas-works ...	42,105 gal.	19,680 gal.	111,000 gal.	112,169 gal.	93,188 gal.	91,758 gal.	90,654 gal.
Total capital	£919,347	£995,519	£1,009,129	£1,031,778	£1,036,137	£1,036,165	£1,038,485
Annual capital expenditure	£251,863	£76,171	£13,610	£22,649	£4,358	£28	£2,319
Outstanding debt ...	£468,237	£503,806	£498,313	£501,505	£485,930	£465,447	£445,114
Net surplus	£13,596	£12,318	£11,452	£2,358	£28,516	£2,800	£3,991 deficit

and 42% above the pre-war sales. It is anticipated that there will be a surplus of £5,000 on the working of the undertaking for the year 1947.

In these difficult times it would not be possible for me to set out a clear-cut plan for the future development of the undertaking for more than a few years ahead. So much depends on the coal situation, the building of property, the industrial development in the town, and the development of the undertaking in the direction of integration, but ample land is available on the existing site for any likely event and it will be possible to tie in new units of the plant to the main scheme without great difficulty.

Coal

At the present time it would be useless and unfair to harass the responsible officials of the Ministry with requests for clean coal and of certain definite qualities. The coal position has been, and still is, very difficult, and none can be insensible of the really excellent work which has been carried out by the various Coal Committees and the Ministry of Fuel and Power during the past six years, endeavouring to surmount insuperable difficulties.

The allocation of coal to industry has undoubtedly been a most difficult and gigantic job during the war years and after, and one can imagine the chaos which would have occurred if control had not been exercised and if coal had not been directed into the various channels. We have chafed against regulations, the interminable form filling, the receipt of unsuitable fuel for carbonizing, but the main feature is this, that the Gas Industry in general has been kept supplied with coal in spite of the very hard winter through which we have passed, and heavily increased usage in many industries. Compared with other countries, both during and after the war period, we have good cause to be grateful.

It seems certain that in the future the Gas Industry will receive the best coals available for carbonizing, because the Ministry knows that in the direction of coal to carbonizing plant the best interests of the country will be served. One can visualize that for many years to come the country will have the greatest difficulty in obtaining sufficient supplies of solid fuel, and the use of gaseous fuel will rapidly increase. It seems certain, therefore, that the Gas Industry will expand to a far greater extent than before the war period, for many years ahead. It is fervently hoped that the re-organization of the coal industry will result in the full production of the coal which is so vitally necessary to the country for the maintenance of its prosperity and standard of living. While this re-organization is taking place it is patent that the Ministry of Fuel and Power is faced with the difficult problem of finding alternatives to offset the coal shortage. The reduction of benzole extraction and the gasification of gas oil may or may not be well received by gas engineers, but it would appear that the position is such that, if improvization is not carried out, drastic cuts in the supply of gas will take place. The heavy usage of gas oil by some undertakings is of financial advantage, whereas others are penalized, but it is obvious this cannot be avoided and there is no question that if every voluntary effort is not made to cut the coal usage to a minimum then the Ministry will have no alternative but to apply a direction Order to secure the desired results.

Gas Distribution

The flexibility of a medium and high pressure system of gas distribution is of the greatest advantage in levelling up the district pressures during the heavy peak loads of the Gas Industry. It is remarkable how well the Industry has taken additional loads of 50% or over since 1939 without recourse in many cases to the laying of large diameter mains from the works. The flexible joint in cast iron mains will no doubt gain in favour in the future. Undertakings supplying gas to new housing estates are meeting with difficulties in securing the necessary materials particularly in the supply of W.I. tubing for service pipes, and it is hoped that production will soon increase to allow the Industry to carry out the work of servicing these huge building programmes. We have always followed the practice of laying lead services and have some 43,000 on this district of supply. As it is not possible to obtain lead for this purpose we are now forced to use, in many cases, steel tubing, and I can foresee trouble ahead in the early renewal of much of this material.

Meters

In connexion with meters I should like to refer to the excellent Paper submitted to us in October, 1946, at our meeting in Morecambe, by Mr. H. Johnston, Deputy Gas Engineer and Manager of Bradford. I regard this Paper as being one of outstanding interest to all gas engineers in these days of increasing unaccounted-for gas. The impedance of meters is a matter which is giving concern to most undertakings, and the results of tests of a batch of meters taken at random from the district would no doubt show where to find and save a considerable proportion of this unaccounted-for gas. During the war period the shortage of new meters, the difficulty of effecting meter repairs, and the arrears in checking up of meters on the district for faults must have been apparent throughout the Industry. The increased gas pressures used at the meter inlets in many areas of gas supply accentuates the difficulties of correct registration of meters and a satisfactory fuel expenditure index figure can be nullified by losses in distribution.

Nationalization of the Gas Industry

As a municipal gas engineer I have little to say with regard to the pending nationalization of the Gas Industry, but the Electricity Bill will give gas engineers a clearer view as to the future working of our own Industry under Government control. In expressing a personal opinion I think that an early integration of some undertakings must of necessity take place in order to conserve fuel, but I do not think

that widespread integration will take place in the very near future and without regard to the economic position. Very careful planning will be required if mistakes are to be avoided.

Institute of Fuel

As a new member of the Institute of Fuel I would direct the attention of all technical personnel in the Gas Industry with suitable qualifications, to the advisability of becoming members of the Institute.

We are all seeking further knowledge in regard to the correct application and conservation of fuel and methods of such application to all industries, including the Industry we serve, and I recommend the seekers of such knowledge to read the *Journal* of the Institute of Fuel, which covers the whole field of the use of fuel in the engineering and chemical world.

The Gas Industry's Technical Press cannot be expected to embrace the wealth of technical information on fuel topics and investigations which come within the scope of the Institute of Fuel, and the Authors of Papers submitted to the various branches of the Institute are the most eminent men and specialists in their respective professions.

Technical Press

In a period of years I have not noted many expressions of thanks to the gentlemen responsible for our Technical Press. Throughout the long years of the war the Editors must have experienced the greatest difficulty in producing their weekly publications with unfailing regularity. We gas engineers are so absorbed in our own particular difficulties that we are apt to forget the work of others on behalf of the Industry. The Gas Technical Press has never yet failed us in spite of paper shortage and in spite of the damage which their plant and offices suffered during the war period. They have provided a medium for that criticism without which no body of opinion can be entirely healthy.

Gas engineers, during the war years, were often loath to give information to the Technical Press which would have been useful to the Industry. This may have been to some extent excusable under war conditions, but there is no reason at all at the present time why we should not provide all possible information likely to be of interest to the readers of the Press. If gas engineers do not provide the information, the Press cannot be expected to disseminate that information, accompanied by appropriate criticism, in the service of the Industry as a whole.

The responsibilities of gas engineers and managers have increased during the past six years and it is only the men who are controlling gas undertakings who know the exacting and difficult conditions and who can express a true opinion on the work. Unfortunately, due to the rising costs of practically every unit of expenditure, most undertakings have been forced to advise progressive increases in gas prices. It is surprising how the general public seem to think that this should not happen, though they willingly pay increased prices for entertainment and luxuries, and even the necessities of life.

Gas Engineers' Guild

I should like to record the very hard work put in by Past-President Sir Frederick West, and also of the valuable assistance of Mr. T. Reynolds, of Stockport, in their endeavours during the past three years to improve the status of gas engineers. It is most unfortunate that their work could not be brought to full fruition through the Institution owing to certain clauses in the Charter. To meet this difficulty the Association of Municipal Gas Engineers was organized in the North West District and this body is to be congratulated on the work carried out during the past three years and the results they have already attained.

In the formation of the Gas Engineers' Guild a real attempt is being made to embrace all gas engineers with suitable qualifications in a Guild to bring the status of the Gas Industry to a height commensurate with its importance in the national economy. Mr. G. E. Currier, M.B.E., Bradford, as Chairman of the Guild has worked very hard to create interest among members of the Institution, and it is difficult to understand the apathy of gas engineers when asked to join an organization which will give them some protection in the difficult years ahead. To be effective, the Guild must have as near as possible 100% membership and it is believed that the Ministry would welcome such a body with whom to carry out negotiations in the future. We are not aware that any comparable protection could be given by any other body and it is therefore all the more surprising that the appeal of the Guild has met with such poor response.

Surely the lack of such an organization has been responsible for the low status of administrative and technical officers in the Gas Industry for years, and now when a wholehearted attempt is being made to redeem the past mistakes there are still so many gas engineers who stand aside, hoping perhaps to secure the best of two worlds. It will indeed be unfortunate if the Guild cannot be made sufficiently strong to speak on behalf of at least 90% of the Institution members, and I look forward to this increase of membership in the near future.

Junior Gas Associations

Most of us owe a great deal of our early training to our membership of the Manchester and Yorkshire Junior Gas Associations. I stress the usefulness of the Junior Gas Associations with their meetings, their visits to various undertakings and contractors' works, and the opportunities they afford of free discussion on all topics connected with the Industry. It would be difficult, particularly in these days, to find an Industry where junior officials will give up so much of their spare time to the seeking of knowledge to fit themselves for senior positions. Whenever it is possible we should allow as many members of our staff who are connected with the Junior Associations to attend the meetings for the ultimate benefit of the undertakings they serve and of the Gas Industry in general.

Conclusion

This country's resources in manpower and materials, after the long period of war with its inevitable exhaustion, must of necessity take time for recuperation. Are we not passing through a most difficult phase of this recuperation at the present time?

A feeling of frustration of effort has undoubtedly been apparent throughout the Industry since the conclusion of the war, but as surely as the war was brought to a successful conclusion, so will this country overcome this exhaustion in the future and despondency will be dispelled. It is up to all personnel engaged in the Industry to pull their full weight in the difficult period ahead in order to obtain the highest efficiency possible from the plant and the fuel available to the Industry.

In closing I hope that the information set out in this Address will add to the interest of the visit which I hope you will pay us in very large numbers in June next. My Chairman and the Gas Committee, I am sure, will make your visit interesting and enjoyable.

I take this opportunity of tendering to my Committee my thanks for their interest in the Manchester District Association of Gas Engineers and for their permission to accept the high office to which you have elected me.

Three-Tier Electricity Industry

If anyone imagined that the Government was going to stop with the nationalization schemes they had on hand at present they were mistaken, said Mr. E. Shinwell, Minister of Fuel and Power, at the annual conference of the Electrical Trades' Union, at Margate, on May 7. There was a lot of talk of what kind of a Government would come in after the present one, but there was only one possible kind which could come in, and that was a Government even more to the Left.

Speaking of the nationalization of electricity, Mr. Shinwell said that the industry would be a three-tier structure. A central authority would be responsible for general supervision of the industry, co-ordination and financial policy, for providing expansion in every possible direction, and in the main for the generation of power.

Then there would be 14 area boards in the country and one for the North of Scotland. The function of generation vested in the central authority could be delegated to the area boards. "The area boards will have as far as is practicable complete autonomy, the reason being that we do not want too much centralization."

There would be consultative councils in each area, with accompanying committees set up by themselves. They would be rather more than consumers' councils. They would have the right to make their representation to the area board and from there they could put to the central authority not only matters affecting the immediate needs of consumers but questions affecting expansion, development, and reorganisation.

The composition of the Board had to have regard to technical, administrative, and other qualities, particularly a knowledge of the organization of workers. They would see in due course that the Government had provided for representation of those who had high knowledge of the organization of workers on a scale that was very reasonable indeed. He begged them not to ask him to say any more about that beyond that in all he had done and would do as regards the selection of personnel for these boards he would consult the representative trade union organizations. It was not always the most popular man who was best fitted to serve on the boards or councils. While they had talked about workers' control he believed many of these ideas and principles, which had been familiar in the Labour movement for many years, could be achieved in another way. Provision must be made for the utmost possible consultation between the workers' representatives themselves and those who were appointed to the boards.

On redundancy, Mr. Shinwell said the Government intended, so far as the electricity supply industry was concerned, to safeguard the rights of every employee. If certain rights were acceded to in the past they would be accepted as an obligation imposed on the new authority. That affected compensation for persons who might be regarded as redundant. He wished that every person could be employed in the industry, but it might be that workers would become redundant because of reorganization. In these circumstances there must be a measure of compensation. There was also the question of pensions, and those matters too would be safeguarded.

Mechanized Accountancy and Statistical Work as Applied to the North Middlesex Gas Company*

By J. D. THOMAS, Local Accountant

THE area served by the North Middlesex Gas Company is eleven square miles situated in the Boroughs of Hendon and Finchley. It comprises mainly good class residential property as evidenced by the rather unusual division of the 32,000 consumers into 22,000 quarterly and 10,000 prepayment, while 5,000 of the prepayment are on current rate, *i.e.*, they are charged with gas and rentals at the same rate as the quarterly credit consumers. The district has been divided into nine sections each with its own sales representative. This division is also used in the accounts department, being useful for sectional balancing of ledger controls, and the build up of statistics.

In 1932 we invited one of the two companies selling the Punched Card idea to make an investigation, but we did not accept the proposition at that time as it was considered that the capital expenditure of some £4,000 was not warranted for a company of this size. In those days we were still using the old type of rental ledger which had four quarters to one page. The meters were read at the end of each quarter and any outstanding balances for residuals, fittings and any hire purchase instalments due, were added to the gas bill. We then changed to continuous meter reading and introduced Kardex flat visible files. These files had the advantage of including in the one opening of the file, the gas, residuals, fittings and hire purchase accounts for each consumer. The system was mainly manual. A National accounting machine was used to prepare the bill and involved the operator in merely reading one line of the gas ledger card to which any outstanding balances for residuals, fittings and any hire-purchase instalments had been transferred. We were pleased with this system from an accounts point of view as it worked well. Continuity and credit control were there, and all debits and credits raised for a consumer were in one position in the file. The system certainly kept to the principle held by our Secretary at that time, of the need for personal knowledge by each district clerk of the consumers' accounts under his control.

Reasons for Changing

Why did we need to change our accounting system? Over the six years to 1938 there was a 25 per cent. increase in the total amount of gas sold. Sales of appliances had increased tremendously; £10,000 hire-purchase outstanding in 1932 had grown to £120,000 outstanding when war was declared, an average of £4 per head of consumer. In the years immediately before the war we experienced fierce competition in Finchley, from the Electricity Department of the Finchley Borough Council.

We asked ourselves, what was the detailed effect of the competition from electricity? We were selling more gas each year. Where was it being sold? Was the increase greater in some areas than others? What was the trend in the various districts? What was the effect of a sales campaign in any area? How were we selling the gas? What would be the cost to the Company if a general block rate or some other tariff was introduced?

The Heyworth Report, when published, emphasized the fact that we in the Gas Industry did not know enough about our gas sales. It was felt that we needed a system which would give us the information we required, year by year, so that we could follow the trend of gas sales in any district. The system would have to enable us to produce the figures quickly and at a reasonable cost. The solution, we decided, was to introduce Punched Card accounting. The system to date has been confined to billing and to some consumption statistics. We shall, in good time, extend the idea to other sections of the Company's accounts.

Mr. H. R. Hazeldine, Accountant of the South-Eastern Gas Corporation, has joined in our deliberations and together we examined installations at Croydon and Guildford. Both these companies had systems which undoubtedly worked smoothly and well. Our impressions confirmed the need for Punched Cards. In March, 1946, an order was placed for the equipment and work was started on the specification for the job, with Oct. 1, 1946, as the starting date. This date was fixed for a number of reasons. At the end of September there were no half-yearly accounts to prepare; the staff had finished their holidays; the temporary staff of married women we had during the war wanted to resign; our pre-war male staff were not likely to return in full strength; it was, therefore, a good time at which to reconstruct the staff of the new department.

Six months was put into completing the specification. An expert from the "Hollerith" Company assisted us in arranging the layout of cards, re-designing the demand notes, &c. We tried to anticipate as many snags as possible, but have had to make many amendments on putting our plans to work. The working report on the billing and the consumption statistics to-day covers 72 pages.

Punched Card Equipment

There are two types of equipment for use with punched cards, one electrical and the other mechanical. We decided on the "Hollerith" equipment because being electrical it seemed to be more flexible. There is a removable plug board incorporated in the equipment which can be set up at will to obtain almost any required results. The punching in the cards is interpreted by a series of electrical brushes. The cards are fed into the machine and pass between the brushes and a roller. Contact is made through the punched holes and the plugging of the board decides which circuits are completed.

The equipment, designed to take 80 column cards, is as follows:

Purchased: 6 Hand punches (£30 each), 5 Hand verifiers (£30 each), 1 Reproducer summary punch (£830).

On Hire: 1 Horizontal sorter, 1 Collator, and 1 Junior Rolling Total Tabulator (£100 per month).

The hand punches are used for punching into the cards from the original documents, information which is to be printed and tabulated. The operation is similar to that of typewriting, the machine spacing automatically as a key is depressed to punch a given hole. The hand verifiers are used by the operators who check the hand punched information. They are similar in operation to the punches except that depression of a key causes a checking of the information already punched. Errors are located by the machine locking, thus drawing the operators' attention to the mis-punching.

The reproducer summary card punch performs the following operations: *Reproducing.*—All or part of the information punched on one pack of cards into another pack (either in corresponding columns or in different columns). *Gang Punching.*—All or part of the information in one card (known as master card) into all the cards following. *Comparing.*—Information punched into one part of cards with information punched in another pack. Attention is drawn to errors by the machine stopping and showing a red light. An indicator shows which columns are in difference. *Summary Punching.*—Automatically preparing cards to record results arrived at in the tabulator. Reproducing and gang punching can be effected simultaneously with summary punching.

The horizontal sorter arranges the punched cards in the various sequences that are necessary for tabulating. The cards are sorted at the rate of 24,000 cards per hour. There are 13 pockets to receive the cards as sorted. One pocket accepts rejects, cards which have no hole in the column being sorted. The machine can be set by means of a selecting device to sort an individual hole or holes in a single column while the remaining cards are passed into the reject pocket without disturbing their sequence.

The collator carries out the function of merging and selecting cards either simultaneously or individually, saving laborious sorting and filing operations. The machine operates at the rate of 10,000 or 20,000 cards per hour according to the class of work.

The Junior rolling total tabulator prints and tabulates from the information punched into the cards the desired results—*e.g.*,

* From a Paper to the Southern Association of Gas Engineers and Managers (Eastern District) April 29.

gas accounts, follow-up notices, coke statements, schedules of debits and credits, statistical analysis, &c. It has four counters for adding and subtracting, each with a capacity of £99,999,999 19s. 11d., and five print banks with the same capacity. In addition to being able to print and add information from the punched card the machine can cross add, and subtract the various totals obtained. There is no rigid or fixed setting of the machine which has a speed of 6,000 cards per hour for printing and 9,000 cards per hour for adding only. The tabulator supplied to us is fitted with a double ribbon device, which saves the cost of one time carbon sheets which would otherwise be necessary to obtain a copy of the gas bill.

In addition to the "Hollerith" equipment we have an electric addressing machine (cost £400) which is used to address the bills after they have been printed, using a metal plate (the address is repeated twice on the account and once on the copy), and an electric embossing machine (cost £280) in which the address plates are embossed. It is possible to blank out and make alterations four or five times on one plate.

The rental of the "Hollerith" machines includes full maintenance and the service we have received has been completely satisfactory. There is always some difficulty with these machines when they are first installed, but once they are run in there is very little fault one can find with them. A monthly maintenance call is made to service each machine and the mechanics are quickly available in case of trouble.

Staff Arrangements

The "Hollerith" Company offer a four or five weeks' course in their school at Letchworth for machine operators and three of our senior girls attended. The course is very comprehensive and finishes with a practical test and a written examination. The result of the tests and a report on each operator is sent to the management. The punch operators attend a fortnight's course in London. These operators are young girls of 15 and 16 years of age, and they soon become quite proficient. For the first few months' working, an installation expert from the "Hollerith" Company is on the job full time, teaching the operators and helping to plan the work. This expert and the "Hollerith" Service Bureau are available when required.

The general clerks have quickly acquired the punched card technique. They have now, after six months, settled down very well and have themselves remarked how much smoother the work progresses. Most of them can use a punching and verifying machine; the senior clerks normally punch the cards required for allowances and adjustments.

It is usual for accounting machine salesmen to try to justify their machines by claiming a saving in cost. We find that the present day salaries of the staff required to work the old system would be approximately the same as the cost of staff required to-day plus the rental of the machines. The position is, therefore, that for the same outlay we are receiving very much more information.

Transfer from Manual System

As at Sept. 30, the hand written ledgers for gas, residuals, fittings and hire-purchase were balanced and cards punched from the schedules of balances. These cards were listed and agreed, merged together to form what we now know as the Open File.

For each meter or appliance on hire a card had to be punched showing the consumer folio, badge number of appliance, description of charge and the amount of the rental. These are permanent cards and form what is known as the Recurring Charge File. Some 57,000 of these cards were required and the assistance of a Bureau was enlisted to punch the cards.

(The Author here gave a detailed description of the cards with specimens and the routine operation of the system.)

Consumption Statistics

The Company have been primarily concerned to obtain as close an analysis as possible of the sale of gas. Of the total gas sold 77.25% is taken by private domestic consumers. As a foundation for these statistics, therefore, we prepared a series of schedules. The "Schedules of Consumers in Road Order," show the quarterly consumptions of gas with other relevant information such as classification of consumer, &c. As these schedules were being printed on the tabulator a summary card showing the annual consumption in therms was prepared on the summary punching machine. In addition to the folio, tariff code, classification of consumer, &c., this annual card includes a card count to indicate the number of readings per year.

After the detailed consumer schedules we prepared a "Schedule of Total Consumption in Each Road," quoting road number, total therms in the road for 1946, number of consumers, and worked out on the comptometer the average therms per consumer in the road. Copies of these schedules have been supplied to the sales department where they will be used by the district representatives, and where they will help the organizing of sales campaigns when such efforts will again be possible. Comparisons between properties in the same road having the same rateable value, &c., can easily be made. It does not follow, of course, that the circumstances of the household in House No. 1 should be the same as that in House No. 3, but a useful general guide is now available. The effect on individual accounts of a sales campaign for, say, gas water heating, should be easily discernible when comparative schedules are prepared in future years.

The load factor for individual consumers is easily read and is a point not to be ignored.

Again using the annual summary cards we sorted them into their various classifications and tabulated the cards to show as "Schedule of Consumptions for each Class of Consumer," total consumption, total number of accounts, with the average per account worked out on the comptometer.

Analysis into Therm Groups

The annual cards are sorted to eliminate all cards having three or less readings for the year. The remainder, each representing a full year's consumption, were sorted into therm groups numbered 1-13, representing 52 therms per annum for Group 1 and so on by stages of a further 52 therms per annum up to 624 therms for Group 12 and higher consumptions for Group 13.

Using the annual cards as master cards we sorted the quarterly consumption cards into these groups on the collator, and further sorted the groups themselves into the four quarters. The separate quarters were then tabulated for each group. From the result it is possible to see how each group takes gas throughout the year. Group 3, the largest group (an average of three therms per week) has a good load factor. Group 13, however, drops to 50% of the maximum demand. These figures supply us with the information we need most, and I know of no other way of obtaining them as reasonably as by punched cards. Over a number of years we shall have a clear picture of what is happening in each district. They would also be immediately available for an assessing of the effect of a new method of charge.

Other than Domestic Consumers

To the annual cards of other than domestic consumers the quarterly cards were collated, sorted into quarters and listed to show how the gas was taken during the year with the results shown in Table 1. The advantages obtained from this type of schedule for companies having a high percentage of non-domestic consumers will be appreciated. Any section showing, *e.g.*, a bad load factor could be further analyzed to give greater detail, by further sorting the groups into separate classes of consumers.

TABLE I.—*Summary of Non-domestic Consumers into Quarters year ended Dec* 31, 1946

District 5—Golders Green

Consumer classification		Total consumption	No. of consumers	First quarter	Second quarter	Third quarter	Fourth quarter
10-22	Manufacturing	28,943.5	10	11,642.0	6,125.0	3,187.5	7,989.0
30-37	Transport, communications and public utility	—	—	—	—	—	—
40-44	Commerce and finance	6,488.0	32	2,152.0	1,439.5	1,384.5	1,512.0
50-58	Civil and local government, hospitals	7,346.5	8	2,021.0	1,784.5	1,435.0	2,106.0
60-62	Professions	6,546.5	20	2,501.0	1,322.0	878.5	1,845.0
70-79	Entertainment, catering, &c.	43,858.5	60	12,195.0	10,195.5	8,201.5	13,266.5
	Total	93,183.0	130	30,511.0	20,866.5	15,087.0	26,718.5

We could elaborate a great deal on these statistics, but I have purposely given only a sample of what information it has been possible to extract from the cards. Others will no doubt have their own ideas as to their value and how they would interpret the information available.

After seven months working we are satisfied the change was worth while, and that we shall be able to prepare the figures we require each year and so give some continuity to our statistics. The advantages gained out-weigh the disadvantages. It is quite true we have not got quite such a ready reference to the personal accounts that we had on the old system. The copy account does, however, help materially in this respect and as the staff grow in confidence and experience this apparent lack in the system will be greatly minimized.

The balancing of ledger controls has been assisted rather than made more difficult. The speed and accuracy with which the balance cards are listed on the tabulator gives a flying start to balancing. The March quarter's ledgers were balanced in about three days. We hope to establish monthly balancing soon; this

has been done for years at Croydon. There, balancing controls each month only took one day. One interesting point in this connexion was the insistence of the Auditors on having the schedules of balances for Dec. 31 reconstructed for two districts. This was something of a test for a department only three months old. We did reconstruct the schedules, however, and arranged for the Auditors to attend in future at balancing time to make any tests they care to make.

It is important to have a staff that are keen on the idea. It would not be reasonable to impose punched card accounting on a staff that are set in the old ways. The system is quite logical, but is a somewhat unorthodox way, by old standards, of keeping accounts. I should like to take this opportunity of thanking my staff for the hard work they have put into the job, for their faith in the idea and loyalty to the Company and to myself. I should also like to thank Mr. H. R. Hazeldine for his confidence in me, Mr. F. Dawson, General Manager, for his encouragement and ready help at all times, and Mr. J. H. Dyde, Director, for giving me this opportunity.

DISCUSSION

The **Chairman** (Mr. J. H. Dyde) asked whether it was a sanguine forecast of the Company's increase in revenue that prompted them to have the junior rolling total tabulator so constructed as to register up to £99,999,999 19s. 11d., or was it due to a fear of inflation?

Mr. **Thomas** replied that the arrangement enabled them to make use of the full number of columns and thus to save work in other directions.

Mr. **E. L. Nicholas** (Guildford) said the Chairman, knowing that his Company had had some experience of the system described by Mr. Thomas, had invited him to open the discussion. In 1932 the Guildford Company acquired the Cranleigh Gas and Electricity Company, an undertaking about nine miles from Guildford with an area contiguous to their own. The Directors of that Company expressed the hope that they would find it possible to retain the existing set-up and character of the local office, and this they did, continuing to prepare and send out the accounts from that office. They were then using the type of rental and bookkeeping usual in small and medium sized undertakings.

In 1940 Mr. M. L. Pitt succeeded him as Secretary and received instructions to modernize the accountancy system. His opportunity came in 1941 when on the retirement of the Managing Director and Secretary of the neighbouring Godalming Company Mr. Pitt and himself were appointed to fill the vacancies. Mr. Pitt saw his dreams of mechanization coming true, for it was obvious that they could not continue indefinitely in the old way with yet a third undertaking to provide for. They heard that Croydon were using a punched card system and went to see it in operation. As a result they came to the conclusion that something of the same nature would suit their purpose. He would here like to pay his tribute to the Croydon Gas Company for the help and courtesy they gave them.

Guildford Installation

Mr. **M. L. Pitt** (Guildford) thanked the Chairman and the District Committee for having chosen for discussion a subject which, while of wide general interest, was of particular interest to accountants, and Mr. Thomas for the able manner in which he had taken advantage of the opportunity given to him. They had the pleasure at Guildford of introducing him to "Hollerith" machines in use and had since followed his progress with interest. The progress he had made in so short a time reflected credit on him, his staff, and his Company, and also on the basic system devised by the British Tabulating Machine Co. At Guildford they were rather proud of having pioneered the introduction of "Hollerith" machines to the Gas Industry, but it was really not such a gamble as it might, on first thoughts, appear to have been. The British Tabulating Machine Co. had put a great deal of research into the application of "Hollerith" to gas undertaking accountancy and had evolved a very sound theoretical scheme before they made any attempt to sell the idea. The billing system which Mr. Thomas had explained was very similar to that original scheme and to the system they were using at Guildford.

He saw the scheme at a time when he was endeavouring to modernize their accountancy methods despite the handicap of wartime staff shortages. He required a system which could be worked by the existing staff, which would give adequate controls, and from which they could obtain duplication of essential records as a safeguard against damage to the main offices by enemy action. The scheme appeared to offer all this. With the help of Mr. Nicholas and his Assistant, Mr. Jackson, he went into it very carefully. They studied the machines themselves and the staffing problem at the British Tabulating Machine Co.'s offices. They paid two or three visits to the Croydon Gas Company's offices to study their Powers installation and they received a great deal of assistance from the officers of that Company. Eventually their scheme was submitted to their Directors for their consideration, and he must at once pay tribute to the support and encouragement he received, particularly from the Chairman, Mr. W. H. Bennett, and the Managing Director, Mr. Nicholas. He was allowed to go ahead with their blessing and a great measure of freedom.

He had said that by adopting a more or less untried system they were not really taking much of a risk. What he meant was this. When they placed their order with the British Tabulating Machine Co. they gave them their chance of an entry into gas undertaking accountancy, a chance for which they had been working for some time. The success of the Guildford installation was as important to them as to the Guildford Company, and as a result they had the maximum assistance from their experts in adapting the original theoretical scheme into a practical system capable of giving the results they required. Their help was invaluable.

Preliminary Work

They had somewhat incomplete records to work from and their first step had to be the introduction of proper balancing and control of all sectional rentals and ledgers. He joined the Guildford Company in 1940 with instructions from the Board to bring up to date the accountancy system. For some years this had been under the immediate control of a Chief Clerk who had had practically 50 years' service with the Company and who had not altered his methods very much in that time. Regular balancing of rentals, &c., was unknown and he learned with some amusement of the complaint of one woman clerk that "we never had debits and credits in this office until Mr. Pitt came." Each member of the staff did his or her particular job quite well, but always as it had been done and without any idea of why it was being done. But he had one stroke of luck in finding in the Cranleigh Branch Manager, Mr. Jackson, a man with a real knowledge of and liking for accountancy. He was transferred to Guildford where all accountancy work was centralized and together they made all the necessary preparations.

They started with billing and took their time about it. In the first quarter they took over only one section of the rentals and then from quarter to quarter they added others. They had three distinct districts, Godalming, Guildford, and the Cranleigh district in which they supplied both gas and electricity. It was important when making such a change to take it in easy stages, allowing the staff gradually to grow into the idea. It was not particularly easy having part of the accounts machine and part manually prepared, but it was a safeguard against the possibility of a breakdown. In the transition stage they were helped by being able to borrow punch operators from the British Tabulating Machine Co., otherwise their staff would have been too small for the double work.

Their billing procedure was similar to that described by Mr. Thomas, differing in one respect only in that they no longer used the ready reckoner files. Their punch operators had become adept at using price charts for converting into therms and pricing. Their extensions were checked daily in total and it was rare for any mistake to have been made and passed by the verifier.

Continuous Meter Reading

When they first introduced the "Hollerith" system they used to read meters quarterly around the normal quarter days, reading the whole district in about a fortnight. This resulted in a heavy rush of work at quarter ends on the punch and machine operators, with an inevitable delay in sending out accounts and completing, balancing, and posting summaries. They had now changed to continuous reading, thus providing an even daily flow of work, and it was a more satisfactory arrangement.

Since completing the transfer of all billing to the machines they had extended their use to the expenditure side. Each normal expenditure head had been given a numerical allocation code—for instance, coal was 100, purification 101, &c., and when it was considered that the system was capable of accommodating up to 999 separate allocation codes it would be realized that it was possible to make a very complete analysis of expenditure if it was required. They did not require anything approaching that number of codes and in fact used the first figure to indicate the department, with other prefix numbers for special purposes. Expenditure fell under three heads—wages, purchases, and petty cash.

In the case of wages the basic information was contained on the employees' weekly time card on which the wages earned were evaluated and the analysis of the total under the appropriate allocation codes noted. For each employee they had a wage and income tax record sheet on which details of wages, income tax, and all deductions, &c., were recorded. From the record sheets separate cards were punched for total wages and income tax, each employee being identified by a number. The cards were sorted in with cards from a recurring charge file which contained each employee's regular deductions for National Insurance, superannuation, &c., and from them was prepared the weekly pay roll, a three-column statement showing: (a) gross wages, which included the Company's National Insurance contributions and income tax refunds, (b) details of all deductions, and (c) the net wage payable to each employee. From the time cards a second set of cards were punched for the allocation of the wages, each card showing: (a) employee's number, (b) allocation code, and (c) amount, and to these were added cards for any income tax refunds (punched from the wages record sheets) and a card for

the total of the Company's National Insurance contributions. The cards were sorted on the allocation codes and a tabulation prepared which must agree with the total of the weekly pay roll.

Purchases, like wages, involved a two-fold operation, the information required being: (a) remittance advices and a monthly payment summary, and (b) an analysis of the expenditure. For both operations the suppliers' invoice was used to provide the punching data. Each invoice on receipt was stamped with a frame in which were spaces for the initials of the checking clerks and the allocation code number, the Company's invoice serial number and the number indicating the supplier. After checking and before being passed to the punch operators each batch of invoices was pre-listed on an adding-listing machine. In respect of each, two separate cards were punched, the first recording the suppliers' number, Company's invoice number, suppliers' invoice number, date of invoice, gross amount of invoice and any credits or cash discount allowable, and the second recording the suppliers' number, the Company's invoice number, date, analysis code, net amount of invoice, and any additional information such as the weight of coal or volume of gas oil purchased. A simple tabulation of the two sets of cards served to agree the totals with each other and with the pre-list. Cards from the first sets punched during the month were sorted monthly on the suppliers' number and a remittance advice for each supplier was prepared, showing the net amount due for the month and full details of how it was made up. Using the same cards a monthly payment summary or creditors' ledger was prepared for the Company's use. The cards from the second sets punched were held for the preparation of quarterly analysis summaries for which they were sorted on the allocation code.

In the case of petty cash only the analysis of expenditure was dealt with by the "Hollerith" Department, the petty cash vouchers taking the place of the suppliers' invoices as the punching data. The cashier kept a simple manual petty cash book totalled weekly and it was with these weekly totals that the allocation cards punched were agreed. As with purchases a quarterly analysis summary was prepared.

So far they had concentrated on the accountancy application of the system rather than on statistics. In fact, the only statistical information they had collected had been that required for the completion of returns to the Electricity Commissioners and the Ministry of Fuel and Power, but it was their intention gradually to develop that side. The installation consisted of three hand punches and two hand verifiers which they purchased, and one horizontal sorter and one 38-column junior rolling total tabulator which they hired at a monthly rental of £36. In conjunction with this plant they used a Hayward Elliott treadle-operated addressing machine. The department was staffed with one machine operator (a female clerk from their original staff, trained at Letchworth), four punch operators and a male senior supervisory clerk who was also able to operate the machines when necessary. The addressing machine was worked by the telephone operator. In addition, to complete the general office and branch office staffs they employed three cashiers, two of whom combined their duties with showroom work, three male clerks (one part time), four female clerks, and two junior female clerks. These were employed on costing stores records, the preparation of fittings and residuals accounts, wages and P.A.Y.E. calculations, the checking and payment of invoices, &c.

Machine Accounting Since 1937

Mr. **H. R. Hazeldine** (Chief Accountant, South Eastern Gas Corporation), in a communication read by the Secretary, said he was in at the beginning when the change in system was contemplated, and he would like to congratulate Mr. Thomas on his Paper. He knew from close association the tremendous amount of work the change over meant to Mr. Thomas and the clerical staff of the North Middlesex Company, but they tackled it resolutely and successfully. When the South Eastern Gas Corporation introduced machine accountancy in the offices of some of the associated companies in 1937 a start was made with all-electric Remington accounting machines. The work done by those machines was confined to gas billing, and although the gas account showed an improvement on the old form and produced a rental sheet at the same operation, thus avoiding the laborious task of casting rentals, the real value finished there, and when a detailed analysis of the consumptions was required by the management it was necessary to extract manually the whole of the consumers' accounts to ascertain what effect any contemplated changes in the price of gas would have on the revenue of the Company. It was also necessary to extract particulars for other purposes, for example, the Ministry of Fuel and Power returns, parochial receipts when a revision of the rate assessment was contemplated, and other statistics which might be peculiar to companies within the Group.

It was probably true to say that gas billing was only one of the benefits to be obtained from the "Hollerith" system, and it should prove of great value in other fields, especially in operating an efficient cost and stores system. It was early to judge the full benefits that would be obtained at North Middlesex from the introduction of the system, but he was sure it had great possibilities, and once established could be readily brought into use elsewhere if desired. There was one question, however, which would probably be in the minds of most people who had listened to the Paper, and that was: "What does he consider to be the minimum size company, judged by the number of consumers, that could use a system of this kind economically?"

Mr. **Thomas**, dealing with the last point raised by Mr. Hazeldine, said even a smaller company than Guildford could very quickly obtain statistical information by using the method adopted during the transition at North Middlesex. Punch operators could easily punch 300-400 cards an hour, so that a small company, with, say, 2,000-5,000 consumers, could obtain the statistics required in a very short time provided the original meter records were classified.

The Load Factor

Mr. **Stirling Everard** (Gas Light and Coke Company) said his interest in the Paper largely rested on the market research angle, and he had never seen anything so comprehensive as the North Middlesex system produced. The grouping of consumptions made it very much easier to introduce block rates and to calculate prepayment weekly consumptions, and the figures and charts given by Mr. Thomas brought out very clearly the importance of the load factor. The average comparison of consumption with rateable value was also of interest. Some work he had done recently on that matter suggested that nowadays people were living where they could, rather than where they desired, and there did not seem to be much relation between rateable value and what they could spend on gas, but later on that would be a very important point. In normal circumstances they should be able to assess the potential gas consumption in a house of a given rateable value. The sort of information that Mr. Thomas had been able to compile should be extremely useful as drafting information for investigators on the district, but there was still a great deal of information that could only be obtained by personal call. For example, one thing he had discovered in some of his work was that in houses of like size and with like apparatus shift workers used more gas than people in regular employment. With such information, backed by the statistics produced by the machine accounting system they could learn a great deal about consumptions and formulate sales policies. Obviously there was no point in trying to sell appliances to people who could not afford to use more gas.

Mr. **R. H. Epps** (Tottenham and District Gas Company) said he had been interested in machine accounting for many years, and what had interested him most was not the system of machine accounting, but the system behind the machine. Unless they had a sound basic system of preparing and checking the information that went into the machine the machine accounting system would not succeed. The accounting machine, unless it broke down completely, could not make a mistake, but they could not run the machine without the human element, and it was the human element which might at some time or other let them down. Perhaps Mr. Thomas could tell them what check he had on the information which went into the machine. Was he certain, or did the system ensure, that no consumer was left out of account, or that a card was not lost without being recovered, or without it being discovered that it had been lost. Was he certain that every therm recorded on the consumers' meters was duly recorded in the machine; or that every quantity of coke sold was recorded.

Mr. **Thomas** agreed that they had to allow for the human element, but described the very complete measures which were adopted to check every transaction. One of the basic principles of the system was that everything that was punched was immediately verified. Badly written figures were a possible source of error; for instance, a bad "3" might be mis-read as "8," but the whole system was as accurate as was humanly possible.

The **Chairman** said he could testify to the enthusiasm behind the machine at North Middlesex. He could speak with the highest praise of what he regarded as a magnificent team.

Mr. **Griffiths** (Uxbridge) added his congratulations to the Author, and said his Company was scheduled to adopt a similar system. It might interest members to know that the area covered by the Uxbridge Company was over 200 sq. miles.

Mr. **K. L. Mortimore** (Hornsey), proposing a vote of thanks to the Author, said that in his view the chief advantage of the system was the information it produced, and the use that could be made of that information.

The **Chairman**, in seconding, said they were greatly indebted to Mr. Thomas for showing them the shape of things to come in the matter of dealing with accounts and utilizing statistics to feed their insatiable sales departments, to help the local authorities in their rate systems, and in meeting the equally insatiable demands made upon them by Government Departments who seemed to be thirsting for their very blood.

Mr. **Thomas**, in a brief reply, said machine accounting was a fascinating business with endless possibilities, and he extended a hearty welcome to any members who wished to see the installation at work.

Furnaceless Heating and Small Gas Furnaces*

By J. F. WAIGHT and J. PALSER,
Industrial Department, City of Birmingham Gas Department

DURING the war workers in the Gas Industry in Britain and America paid a great deal of attention to the development of high intensity gas burners, and their application to industrial heating processes. In America, stress has been laid on those heating processes associated with mass production methods, and attempts have been made to design the heating apparatus as a heating machine rather than as a furnace.

A high combustion intensity is characteristic of all the burner systems developed, and this has been achieved in the main by increasing the pressure at which a fully-aerated gas is supplied to the burner flame ports, and regarded in this way, the burners perhaps represent only extensions of existing practice. In applying the burners, the high rate of heat liberation, and the high velocity at which the products of combustion are discharged, are used to reduce the size of the furnace structure and, in some cases, to eliminate it entirely. To describe this design technique, the term " Furnaceless Heating " has been used, and, although the term may be slightly inaccurate and can only be truly applied to a small number of cases, the Authors have used it

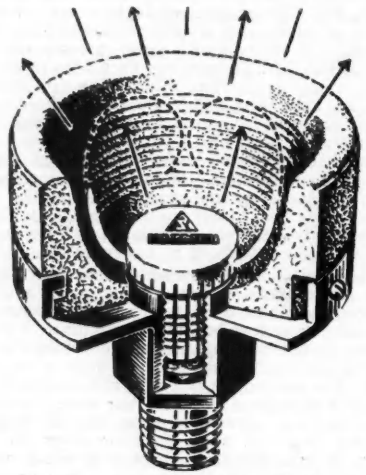


FIG. 1.—*The American " Radiant Cup " burner*

since applications of the high intensity burner of which they have had direct experience, have shown that in certain cases considerable reductions may be made in furnace structures to achieve a given result. Articles may be heated as they are passed mechanically through a simply constructed heating zone, or they may be heated in small batches so rapidly that the production capacity of a large furnace is obtained with a much smaller unit.

The "C.C." Burner

The high intensity burner which has become known as the concentrated combustion burner, or briefly as the " C.C." burner, consists essentially of an air jet and entrainment throat, a mixture tube and nozzle, and a refractory burner tunnel. The air jet, mixture nozzle and burner tunnel have all been sized so that the momentum of the initial air stream is preserved throughout the system, and as a result the products of combustion emerge from the burner tunnel with the maximum possible velocity.

The last statement implies that combustion is completed within the tunnel, and this appears to be true, since in use and when correctly adjusted, no flame can be observed within the working space, or adjacent to the tunnel exit, although outside the working space, there is the usual fringe of flame which occurs when gas burners are adjusted to produce conditions of maximum temperature.

In one burner tunnel for air pressures up to 1.5 lb. per sq. in., assuming that combustion is completed within the space enclosed by the refractory burner tunnel, heat is liberated within this space at the rate of 29.8 by 10^6 B.Th.U. per cu.ft. per hour. The maximum flame temperature of a typical 450 B.Th.U. gas as calculated by the method due to Lewis, Seaman and Jones[1] is 1,920° C., and based on this figure, the gases leave the tube with an average velocity of 250 ft. per second. Measurements made on the gases as they leave the tunnel however, indicate that the temperature is somewhat lower than 1,920° C., and in consequence the velocity of issue would also be somewhat less than that mentioned. The high-temperature developed within the tube make it necessary to use a highly refractory substance for the construction of the tunnel. Rammed refractory cement mixtures have proved fairly satisfactory, but performed sillimanite tunnel blocks are now used and have given extremely satisfactory service. Burner tunnels may be used singly or they may be readily built into compact groups.

The " C.C." burner is designed to operate on low pressure gas and fan air, and in this respect it differs from its American counterparts, all of which seem to have been designed to operate on a fully-aerated gas mixture supplied by a Premix proportioning system.

Two American burners have been chosen for description—the " Radiant Cup " and the " Cell " types, both of which are marketed by the Selas Corporation of America.

The "Radiant Cup" Burner

As its name suggests, the American " Radiant Cup " burner is used as a radiator, but its design is such that the primary heat transfer between the hot gas stream and the radiating surface is by forced convection. The burner is shown in Fig 1, and it will be seen that it consists essentially of a refractory cup held within a metal surround. At the centre of the cup bottom there is screwed an accurately made ceramic burner head having flame ports distributed around its periphery. In use, combustion is completed entirely within the region of the cup, the inner surface of which is rapidly raised to a high temperature by a stream of products of combustion which move at the high speed which is a consequence of the mixture pressure employed. The burners are designed to operate with Premix gas plants delivering a fully-aerated gas mixture at pressures up to 5 lb. per sq. in.

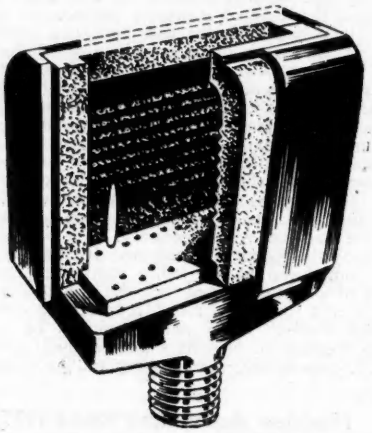


FIG. 2.—*The " Cell " burner*

In use the burners are intended to stud the walls of a chamber which closely fits the charge, or in the case of travelling loads, they are fitted in close pattern to walls which are positioned as near as possible to the work being heated. The following figures[2] obtained from an American communication illustrate the high rates of heating which have resulted by the use of these burners :

Test piece	Temp. °C.	Time (minutes) Heating	Equalizing	Total
Steel billet, 5.5 in. by 5.5. in. by 10 in.	1,180	14.5	4.5	19
Brass billet, 8 in. dia. by 15 in.	830	14.5	1.0	15.5
Steel billet, 2.25 in. by 2.25 in. by 2.75 in.	1,300	4.5	0.5	5.0
Tellerium nickel brass rod, 1 in. dia.	830	0.568	0.258	0.826*

* Continuous feeding of 20 ft. lengths of rod through a chamber measuring 3.25 in. by 3.25 in. by 13. in. at a rate of 23 in. per minute. The equalizing time quoted in this case is actually the time required for an element of the rod to pass from the hot zone to the quenching sprays.

* Paper before the Sheffield Section of the Institution of Production Engineers, Feb. 19.

[1] " Technical Data on Fuel."

[2] H. W. Smith, " The Iron Age," Mar. 8, 1945.

Another American burner, the "Cell," is illustrated in Fig. 2. This is primarily designed for convection heating. Gas premixed with its full combustion air requirement is delivered at high pressure to a perforated ceramic plate fitted at the bottom of the small ceramic-lined cell, within the confines of which combustion is completed at rates from 35×10^6 to 60×10^6 B.Th.U. per cu.ft. per hour. The resulting stream of intensely hot products of combustion is ejected at high velocity from the narrow burner slot, and is directed on to the material to be heated. It is useful for operations requiring localized heating, and some of its applications were described in a Paper entitled "Function Fitted Combustion" given by H. W. Smith to the American Society of Mechanical Engineers. The following example of its use was taken from this Paper: "A group of burners of this type were employed to make 1,850 brazed joints in an 8-hour day as compared with a previous peak figure of 560 similar joints per day on a much more costly induction heating unit." Unfortunately the Authors have had no opportunity of seeing these American developments in operation, and they are awaiting with interest the application of the burners to industrial process work in this country.

Principles of Application

These high intensity burner systems are generally employed in such a manner that the convection heat transfer component is enhanced to an extent that the heat transfer area swept by the hot gases, or the time of contact by the material being heated, may be considerably reduced to achieve a given result. To illustrate this statement, it would be useful to examine briefly the heat transfer methods that are employed in natural draught furnaces of orthodox construction, that is furnaces having a vault to hearth ratio of about 3 to 1.

The working medium in such a furnace consists of a mixture of CO_2, N_2 and H_2O, which enters the working space at a high temperature, and which during its passage to the flue exists will lose heat to the furnace structure and the charge, and in consequence should leave at the lowest possible temperature consistent with the working temperature of the apparatus.

The heat given up by the working medium is transferred by radiation and convection. Apart from the temperature difference between the working medium and the receiving surfaces, the former is dependent on the dimensions of the gas stream, and the concentration of H_2O and CO_2, the latter on the velocity at which the gases flow over the heat receiving surfaces.

If the furnace is open fired, then the charge will obtain its heat by these methods of heat transfer, and also by secondary radiation from the walls and crown of the working chamber. Under the influence of natural draught, the velocity at which the gases move through the furnace is usually between 10 and 25 ft. per second, and with such conditions the direct transference of heat to the stock by convection may be low as compared with the transfer by gas radiation and by secondary radiation from the furnace structure. For this reason it is arguable that a large area of gas swept brick radiating surface is advantageous since it tends to reduce the temperature of the working medium to a value more nearly approaching that of the furnace lining. This is true, but it must be remembered that each sq. ft. of interior wall surface has associated with it a mass of brickwork which possesses thermal capacity and thermal conductivity, and each of these represents a source of heat loss, the former having a maximum influence when the furnace is being raised to temperature, and the latter a maximum influence when the furnace is operating at its working temperature.

A furnace measuring 1 ft. high by 4 ft. wide by 3 ft. deep with an average construction of 9 in. refractory and 4½ in H.T.I. would absorb approximately 1.9×10^6 B.Th.U. to bring it to a condition of equilibrium with a hot face temperature of 1,300° C. and the approximate conducted heat loss would be 26,000 B.Th.U. per hour. A reduction in size of the furnace structure for a given output is, therefore, a matter of importance not only from the point of view of first cost and floor space, but also heat economy. In stressing the last point, it must be remembered that each unit of heat conducted through the furnace wall is applied by cooling a quantity of combustion gases to a temperature which cannot be lower than the hot face temperature, and this means that the heat actually supplied to meet the loss through the wall is given by multiplying the quantity lost by a factor greater than unity, and given by the expression $\frac{Io}{Io - It}$ where Io = maximum heat capacity of 1 cu.ft. of working medium, and It = the heat capacity of 1 cu.ft. of working medium at the working temperature, these values being based on the net calorific value of the fuel employed. For town gas having a net calorific value of 403 B.Th.U. per cu.ft., Io at flame temperature would be 92.5 B.Th.U. per cu.ft., and at 1,300° C. would be 62.2 B.Th.U. per cu.ft. Thus the factor for a furnace operating at 1,300° C. would be 3, and every 100 B.Th.U. lost through the wall would require 300 net B.Th.U. to be supplied by the burner, assuming that the gases are cooled to the temperature of the wall.

In applying the "C.C." burner to maximum advantage, the high velocity of the products of combustion are conserved as much as possible within the working space, and where the tunnels cannot be directed on to the stock, they are directed over the brick surface in order to obtain the maximum value of secondary radiation. Owing to the high gas speed, the convection coefficient is high, and, as a result, a smaller area of brick surface is needed to produce a given heat drop in the working medium. Indeed, the brick surface has to be reduced as, in order to maintain a high velocity within the working space, clearances must be reduced to a minimum. This process of increasing the rate of heat supply per unit area of gas swept surface, also increases the temperature of the surface, and hence the radiation component of heat transfer.

In stabilizing the wall temperature at a higher value there is a tendency to increase the exit temperature of the working medium, but it is possible to show very approximately that the higher flue loss occasioned by an increased exit temperature is, within limits, offset by a reduction in the conducted wall losses.

Consider two furnaces "A" and "B" standing at equilibrium with lining temperatures T_1 and T_2 respectively, each lined with 4½ in. refractory and 4½ in. insulation. The B.Th.U. conducted through such a wall can be approximately related to the lining temperature by the following law:

$$\text{B.Th.U. per sq. ft. per hour} = 0.675T - 60.$$

Assuming that the gases are cooled to the temperature of the lining, and that the working medium enters at flame temperature, the volume Q of working medium required per hour will be:

Furnace "A"

$$Q_1 = \frac{A_1 (0.675T_1 - 60)}{I_0 - I_{T1}}$$

Where A_1 is the area of the lining and I_0 and I_{T_1} have the meanings assigned to them in the preceding paragraphs.

Similarly for Furnace "B"

$$Q_2 = \frac{A_2 (0.675T_2 - 60)}{I_0 - I_{T2}}$$

For equal fuel consumption $Q_1 = Q_2$

and $$\frac{A_1 (0.675T_1 - 60)}{I_0 - I_{T1}} = \frac{A_2 (0.675T_2 - 60)}{I_0 - I_{T2}}$$

Assuming constant specific heat

$$I_0 - I_{T_1} = \frac{T_0 - T_1}{(T_0 - 15)} \times I_0$$

and also

$$I_0 - I_{T2} = \frac{T_0 - T_2}{(T_0 - 15)} \times I_0$$

$$\therefore \frac{A_1 (0.675T_1 - 60)}{T_0 - T_1} = \frac{A_2 (0.675T_2 - 60)}{T_0 - T_2}$$

Putting $T_0 = 1{,}920$ and $T_1 = 1{,}300$, and $A_1 = 2A_2$, we obtain a value for $T_2 = 1{,}550°$ C.

Thus, if furnace "A" is operating at 1,300° C., then furnace "B" if it had half the area of furnace "A" would operate at temperature 1,550° C.

The reasoning is over simplified and perhaps crude, but it indicates the possibilities of this method of approach to furnace heating problems. If the temperature produced in furnace "B" is sufficient to increase the speed of heating so that the output of furnace "A" is obtained, then a smaller furnace will have been built to produce the same output, and heat will be saved every time the apparatus is raised to its working temperature.

In practice, using "C.C." burners, it has often been found possible to produce a greater output from the smaller furnace for the same fuel consumption.

Heat Transfer Rates

The Authors would have preferred to present an analysis of the heat transfer obtained in apparatus fired by "C.C." burners. It would be difficult, however, to reconcile published heat transfer data that has been obtained with fairly simple geometrical shapes with the complex gas flow, radiation, and temperature conditions which obtain in any apparatus operating with high intensity burners. No attempt, therefore, has been made to separate rates of heat transfer into convection and radiation components. Some comparison with normal practice is, however, necessary, and it has been decided to use as a criterion the figures generally quoted for steel heating processes. The figures given by Trinks and by many other authorities express the heating rate as so many lb. of steel heated per sq. ft. of hearth area per hour; they are as follows:

Heat treating	30 lb. per sq. ft. of hearth per hour
Annealing	60 lb. per sq. ft. of hearth per hour
Forging	80 lb. per sq. ft. of hearth per hour

Another figure also in general use for low carbon steel is 20 min. per in. of thickness.

The danger of damaging the charge imposes a limit on the rates employed for heat treating and annealing, and so, in order to make a comparison, the last two figures quoted have been chosen. For this

purpose they have been reduced to an overall heat transfer rate expressed as B.Th.U. per sq. ft. per hour, assuming that in the case of bars and plates, the upper surface of the stock only is used to transfer heat to the interior of the charge, and that, in the case of round billets, the whole surface of the material is used in the heat transfer process. On this basis, and allowing 330 B.Th.U. to raise 1 lb. of steel to forging temperature, the heat transfer rate for 80 lb. of steel per sq. ft. of hearth per hour is 26,400 B.Th.U. per hour per sq. ft. of exposed stock surface, and for round billets, the rate becomes $\frac{400{,}000\ L}{(D + 2L)t}$ B.Th.U. per hour, where L and D are the length and diameter in inches respectively, and t is the heating time in minutes allowable per inch of diameter. For the given rate of 20 min. per inch, and for billets where the diameter is small compared with the length, the figure becomes 10,000 B.Th.U per sq. ft. per hour. Typical rates obtained on "C.C." fired apparatus are as follows:

Pin heating for bolt heading, neglecting end loss	85,000 B.Th.U./sq.ft./hr.
Billet heating for forging	42,000 B.Th.U./sq.ft./hr.
Heating a ½ in. sphere held 1 in. in front of the burner tunnel, and with no enclosing brick surface..	140,000 B.Th.U./sq.ft./hr.

Operation

In operating an orthodox furnace, it is generally arranged that the temperature of the working chamber will be only a relatively small amount higher than the final temperature required in the stock. In batch type heat treatment furnaces, it is often the practice to set the furnace control at a temperature coincident with that required in the material, the latter thereby being brought to furnace temperature on a curve which tends to flatten at the final stage of heating. This technique produces accurate heat treatment but it is not conducive to rapid working; it may be inefficient unless some form of waste heat recovery is employed.

If Q = the amount of heat which will be absorbed by the work.
A = the area of the furnace lining.
t = the time required to bring the work to temperature.
K = conducted heat loss per sq. ft. of furnace wall.

Then, very approximately, the net amount of heat required for the operation will be given by the expression:

$$H \text{ heat units} = (Q + K.A.t)\left(\frac{I_0}{I_0 - I_T}\right)$$

In operating equipment fired by high intensity burners. a different technique is used:

A is reduced and owing to the high temperature potential, t is also reduced, and this produces control difficulties, since clearly work will be spoiled if left too long in a heating zone which normally operates at a temperature much higher than that finally required on the charge.

Temperature control of the work, therefore, is usually based on a time cycle supported in some cases by control of the temperature of the brick radiating surface. In some applications, temperature control is not used, but the work is traversed mechanically through the heat zone so that the exposure time is controlled, or it may be that the operator is trained to a definite loading and unloading schedule.

Where the refractory surface temperature is controlled, it may be set above the desired working temperature, but if there is a sufficient margin, at a point below spoiling temperature. The operator handles the work to a time schedule so that correct heating is achieved, provided this schedule is adhered to, but in the event of it being neglected, serious overheating is prevented by the limit temperature control.

(*To be continued*)

The British Industries Fair

It is eight years since the triumph of British industry was last exhibited at Castle Bromwich. That during those years designers and manufacturers have not been idle is immediately apparent upon inspecting some of the thousand or so stands at the 1947 British Industries Fair, which opened on May 5 and will continue until May 16. In previous years the "GAS JOURNAL" has published a special supplement describing those exhibits of interest to the Gas Industry. We regret that paper restrictions make it impossible for us to do so this year and we therefore give below a brief review of exhibits.

The most important of the exhibits in the Gas Section is undoubtedly that of the **British Gas Council.** Entitled "Gas in Industry," the stand shows, in particular, the application of gas to infra-red drying, the concentrated combustion burner, and the permeable lined furnace. The infra-red units shown are typical of many in use throughout the country for paint drying and similar purposes, results being extremely rapid. The concentrated combustion burner is shown both as a separate unit and also incorporated in a "Cyclone" furnace. Its ability to burn a large quantity of gas in a very small space with a resulting high temperature has made it of great value for such purposes as the local heating of components, such as hammer heads or jaws of spanners which need considerable hardening. The permeable lined furnace incorporates a permeable refractory lining, the products of combustion being extracted through the actual refractory by means of suction applied to the annular space by an ejector. Under hearth firing is employed by means of six special air blast burners. The furnace can rapidly attain working temperature and is suitable for all general heat work at temperatures up to 1,200° C. Another recent development is the "Per-Ignitable" injector, shown both as a separate unit and also fitted to the burners of a bakelite moulding press. Its chief advantage is that it will provide a very highly aerated flame without lighting back, and even if deliberately lit back at the jet, the flame will travel forward inside the burner tube until it reaches the intended point of combustion. Other types of injectors and burners are shown and of particular interest is the internally-heated recuperative radiant tube heating element. The stand includes a range of furnaces for the heat treatment of ferrous and non-ferrous metals, tempering, forging, hot brass stamping, and pottery firing, most of them being shown with suitable pyrometer and automatic temperature control equipment. Also shown are drying stoves, types of space heating units and a steam boiler. Makers of individual exhibits include :—

Aeromatic Co., Ltd., "Per-Ignitable" injectors applied to a 50-ton hand-operated plastic press, soldering iron; Allday, William, & Co., Ltd., hot brass stamping furnace, cycle brazing unit; Amal, Ltd., flame traps, industrial injectors, calibrated jets, pilot lights, industrial and laboratory bunsen burners; Askam, John F., Ltd., circular tempering bath; Ballard, F. J., & Co., Ltd., double-cased internally-heated batch type oven; Birlec, Ltd., recuperative radiant tube heating element; Bratt Colbran, Ltd., overhead radiant heaters; Brayshaw Furnaces and Tools, Ltd., high speed steel furnace; The British Thermostat Co., Ltd., capillary gas thermostat; Chance Brothers, Ltd., "Flamemaster" gas/air, gas/oxygen hand torch, "Flamemaster" bench burner; Cochran & Co., Annan, Ltd., "Sinuflo" boiler; Potterton, Thomas (Heating Engineers), Ltd., radiant heat (infra-red) unit; Radiant Heating, Ltd., overhead radiant heaters; The Dowson & Mason Gas Plant Co., Ltd., gas-heated tank; Electroflo Meters Co., Ltd., pyrometer indicating equipment; Evered & Co., Ltd., governors and injectors; Fuel Furnaces, Ltd., natural draught furnace; Griffiths, A. E. (Smethwick), Ltd., air-circulated drying oven; Heat and Air Systems, Ltd., air heaters; Hind-Griffiths Furnaces, Ltd., continuous decorating kiln; Holmes, W. C., & Co., Ltd., lead melting pot, gas-fired immersion heater; Honeywell-Brown, Ltd., safety devices; The Horstmann Gear Co., Ltd., industrial gas controllers, comet igniters, gas pistols; The Incandescent Heat Co., Ltd., forging furnace, permeable lined furnace; J. L. S. Engineering Co., Ltd., hot air circulating furnace; Jeavons Engineering Co., industrial governors; Keith Blackman, Ltd., mixture controller, burner heads, single diaphragm safety shut-off valves, safety shut-off switches for motor-driven gas boosters, parkerizing burners, soldering irons, two-arm stamped pattern injector, suction burner, unit air heater, air blower; Liptak Furnace Arches, Ltd., "Gako" burners; Lucas Furnaces, Ltd., natural draught oven furnace; Manchester Furnaces (1934), Ltd., salt bath; Matthew Hall & Co., Ltd., radiant heat (infra-red) tunnel; Fletcher, Russell & Co., Ltd., tinman's stove, laboratory muffle furnace, industrial injectors, laboratory bunsen burners, blowpipes, luminous burner for industrial application; Rycroft & Co., Ltd., high duty burner; The Selas Gas and Engineering Co., Ltd., gas and air mixing plant, muffle furnaces, laboratory crucible furnace, laboratory sand bath combustion tube furnaces, laboratory bunsen burners; Serck Radiators, Ltd., unit air heater; Stott, James, & Co. (Engineers), Ltd., automatic glue liquefying cabinet; Tiesen, Th., C.E., hexagonal recuperator tubes for gas-fired furnaces in glass, enamelling, and iron and steel industries; Thermic Equipment & Engineering Co., Ltd., "Cyclone" forge furnace, concentrated combustion burner.

The large island stand of **Radiation Ltd.,** has as its highlight the 4-oven Grosvenor range with bain marie. The range is demonstrated and shows externally and semi-externally heated ovens with and without Regulo automatic oven-heat control and the various types of hot plate burners available. The new Confector pastry oven, which is exhibited for the first time, is designed to meet the requirements of hotels, restaurants, &c., for baking pastries and

general confectionery. Among the other examples of large-scale cooking apparatus are the Kendal roasting oven, Belgravia hot closet and carving table, Keswick vegetable and pudding steamer, Langham vegetable boiler, Multi-Serve milk warmer, and Savoy griller.

One of the most effective and attractive stands is undoubtedly that of **De La Rue Gas Development, Ltd.,** which is devoted exclusively to infra-red industrial drying plant constructed in many varying forms with the gas-fired unit panel (Potterton type) as the basis of heating for all installations. A complete plant, consisting of spray booth, 24-panel convertible and enclosed tunnel with overhead conveyor, is in operation, and articles of varying size are sprayed and run on the conveyor at a speed of one article or batch of articles every six minutes. Numerous examples of articles that can be so treated are displayed with photographic enlargements of the plant as used by prominent manufacturers.

A large selection of catering equipment is to be seen on the stand of **James Stott & Co. (Engineers), Ltd.** The exhibits include the Junior water boiler and its larger size, the Senior, which is available in two models, for hot or boiling water, or boiling water only. The Autofry fish frying range has thermostatic gas control as a standard fitment which maintains the fat at any pre-set, desired cooking temperature, and effectively guards against fat wastage. The Stott steamer is also thermostatically controlled, fitted with automatic air release valve, and is automatically fed from a cold water cistern and arranged with a wheel-type locking device on the door for slow shutting and steamtight cooking, the door packing being of solid square section asbestos. Also shown are a bain marie, water boiling urn, hot-cupboard, cafe sets and a tea trolley.

G. L. Howarth & Co., Ltd., show a range of washing machines and wash boilers, most striking of which is the Rapid washing machine, which is exhibited in black and white and also mottled grey vitreous enamel. The table top can be arranged in two positions. The 11-gall. copper pan has a corrugated interior to give improved agitation and the machine is fitted with an Acme roller wringer. A 10-gall. capacity boiler, finished in vitreous enamel, is supplied with a loose table top which enables it to become a kitchen table when not in use. Another boiler shown, of the same capacity, has a galvanized outer case and protector plate, lift-out pan and circular lift-off polished copper lid.

Examples of water softening apparatus are shown by **The Permutit Co., Ltd.,** including softening processes for boiler feed and industrial process waters and softening by precipitation and "Spiractor." Of particular interest is the Permutit portable "Deminrolit" plant which provides a simple means of producing small quantities of water of distilled quality, the water being demineralized by a chemical process requiring neither heat nor power. The capacity is 50 gall. between regeneration when treating a water of similar quality to that of the M.W.B. Supply, London. When the plant requires regeneration, indicated by an electric tester, this is effected by sulphuric acid and sodium carbonate solutions prepared in a collapsible P.V.C. tank. Total weight is only 56 lb.

Cochran & Co., Annan, Ltd., show a multitubular vertical boiler, 7 ft. dia. by 5 ft. high, for 100 lb. per sq.in. working pressure. It is complete with the usual fittings, including brick-lined backplate, smokebox, preliminary length of 32 ft. chimney and set of Cochran mountings. On the stand of **Prior Stokers, Ltd.,** is demonstrated another Cochran multitubular vertical boiler, this time of 5 ft. dia. by 11 ft. 3 in. high for an equal working pressure. Also on this stand is a "bunker-flow" stoker, in actual operation, taking coal direct from a small bunker at the back of the boiler. The steam raised in this boiler is used for process work on the neighbouring I.C.I. stand.

Gas-fired air heaters are the speciality of **T. E. Salter, Ltd.,** and examples of these are to be seen upon their stand. The heaters, which can supply warm air up to 500° F., are of cast iron plate construction throughout, lined in the combustion chamber with refractory and insulating bricks, and in the upper portion with insulating material. The lower tubes are constructed of special heat-resisting alloy. Shown on the stand is a new model size 4A, mid-way between the former models 4 and 5.

Any award for novelty should be presented to the **Oxley Engineering Co., Ltd.,** who are exhibiting a most impressive working model of a gasholder, constructed by a member of their staff. The model is of a two-lift spiral guided holder, with a 6 ft. diameter tank, and embodies all the patented features of the Oxley all-welded holder, showing in particular the effectiveness of the pressure relief ducts.

Exhibiting for the first time at the Fair are the Balfour Group of Companies, comprising **Henry Balfour & Co., Ltd.,** manufacturers of gas-works plant, **George Scott & Son (London), Ltd.,** chemical plant manufacturers, and **Enamelled Metal Products Corp. (1933), Ltd.,** makers of glass-lined steel tanks and vessels. On the Companies' stands are shown a series of models, including a complete gasification plant, a complete spray drying equipment for the preparation of dried milk products, and a triple effect evaporator, in addition to various exhibits of the Companies' products.

A large selection of gas controllers are to be seen on the stand of the **Horstmann Gear Co., Ltd.** The Newbridge Comet igniter has been on the market since 1935, and the Mark IX model is attached as a complete unit to the clock controller and the 1½ volt battery is contained in a chromium-plated cylinder. When set to give a flame of four seconds' duration, the amount of gas consumed is only 0.0005 cu.ft. per day. The Type 3A/UNI controller, with compression unions and fixing bracket for gas-fired central heating boilers, has a 15-day run clockwork movement incorporating an 11-jewelled platform lever escapement; an arrangement can be supplied to cut out operation on any specified day, or days, per week.

Sigmund Pumps, Ltd., are exhibiting a range of refinery process pumps, a feature of which is the novel casing design, embodying suction and delivery branches, enabling the use of only one joint under pressure. Another feature is the use of the spacer type coupling, whereby the whole rotating element can be dismantled for inspection, without disturbing the alignment of the pump casing and prime mover. The three representative types of these pumps are single-stage, simple-entry, overhung impeller type; single-stage, double-entry impeller type; and two-stage single-entry "back-to-back" impeller type—the double-entry and the two-stage types having bearing support on each end of the shaft. Other exhibits include the Sigma D type low lift pumps for irrigation purposes and a non-clogging pump for liquids containing solids.

Several types of diaphragm valves are exhibited by **Saunders Valve Co., Ltd.,** such as screwed and flanged models with bodies in acid-resisting bronze or cast iron and lined, when necessary, with ebonite, glass or lead. The diaphragms are supplied in several grades to resist corrosion or erosion. Sectional models demonstrate how the flexible diaphragm isolates the mechanism from the fluid and examples of quick acting models provide an opportunity for comparing the merits of piston and air motor operation for conditions in which wheel or lever operation is inadequate or inconvenient. Also exhibited is an automatic shut-off valve for collieries and three models of the Safran centrifugal pump.

The island stand of the **Stanton Ironworks Co., Ltd.,** has as its main exhibit a selection of spun iron pipes and flexible joints. The Stanton centrifugal method of casting pipes in water-cooled metal moulds has resulted in a record of 42,000 miles of pipe in use throughout the world. Demonstrated under pressure is the screwed-gland joint, while other types of flexible joint are exhibited. The centrifugal method of manufacturing concrete has been applied to Stanton lighting columns and, incorporated with a welded steel reinforcement frame, an example is on view. Mechanically ground after spinning to a fine granolithic finish, the density of the concrete will resist corrosive atmosphere without maintenance. Also shown are castings made from Dale refined pig iron, originally designed to meet the demand for greater control in the manufacture of high-duty irons, obviating the need for the use of high proportions of steel scrap in cupola changes and the addition of ferro-alloys.

Wellington Tube Works, Ltd., exhibit samples of the gas, water, and steam tubes for which they are well known, but in addition, the many other uses to which these tubes can be put are demonstrated. Exhibits include examples of how tubular construction may be used for structural steelwork, gates, trucks, racks and fencing posts, while a model truss roof of all welded tubular manufacture, complete with purlin fixings, is a sign of the times in building methods. Also illustrated is a portable tubular frame canvas building manufactured during the war for bomber repairs for the R.A.F., and examples of how this type of structure may be used. The stand includes Plenum and Unit heaters, manufactured under the name of Weldex, and a variety of stampings and forgings, manufactured and marketed by a subsidiary, Job Edwards, Ltd.

Evidence of the versatility of asbestos for building purposes is demonstrated by the **Universal Asbestos Manufacturing Co., Ltd.,** whose stand contains a very wide selection of their products. Flat and corrugated sheets, metal-reinforced decking, troughing, purlin tiles, and underlining sheets for double roofing are shown, in addition to numerous fittings, such as guttering, pots and tallboys, flue goods, and ventilators. An interesting product is the range of cooker hoods and bases.

Specialists in plant in welded stainless steel, monel, nickel, nickel-clad, in addition to mild steel used in the chemical industry, **G. A. Harvey & Co. (London), Ltd.,** have a stand of considerable interest. Although the Company's products range from small high-pressure autoclaves for 3,000 lb. working pressure, up to large fractionating columns as long as 153 ft., the extensive range

of Harco perforated metals is of particular interest to visitors, embracing innumerable patterns needed for all kinds of sifting, filtering, and grading. Also shown are radiator covers, pipe-guards an dventilating grilles, and samples of Harco woven wire cloth, produced in all meshes and gauges in all metals. In particular, mention should be made of the wire screens used for vibrators. Pressed steel gutters of many sizes and ventilators are another feature, while the Harco Tapergil type of gilled tubes is shown in a great variety of diameters and pitch of gills.

The Copper Development Association stand illustrates the mining, smelting, refining, and fabrication of copper and the industrial applications of copper and its alloys, by a series of exhibits extending from specimens of ore, concentrate, semi-finished products, such as sheet, strip, tube, pressings, stampings, castings and forgings, to finished articles. A model house is equipped with roof flashings and rainwater goods of copper, as well as such parts as the pipes, damp proof course and hot-water cylinder. Another exhibit is a model of the Ministry of Works plumbing unit, which involves the use of some 8,000,000 ft. of copper tube. The stand illustrates the advantages of copper piping for gas carcassing and of copper roofing, the latter being widely used for building purposes at the present time.

The background to the stand of **Murex, Ltd.,** consists of a large map of the world, showing the sources of many of the ores and raw materials treated at the Murex Works and the flow of the resulting metals, alloys, and chemicals to many industries. The products displayed include carbon-free Ferro Tungsten, Ferro Vanadium, Ferro Molybdenum, Ferro Titanium, Ferro Columbium, and many others, in various sizes and to various analyses. Thermit, a mixture which on ignition reacts at a high temperature, and produces metal and slag and intense heat, is shown in sample form. Murex, Ltd., are also exhibiting a wide range of electric arc welding plant, accessories and electrodes. A mobile 400 amp. Diesel engine driven set, a 250 amp. self-contained welding transformer, a 300 amp. motor generator set complete on a trolley and fitted with a Murex remote control regulator is also shown. Demonstrations in the welding of ferrous and non-ferrous metals include the new type PV electrode, designed for welding deep groove type butt welds in thick mild steel.

R. & J. Dick, Ltd., show a selection of their power transmission units, including flat belting and vee ropes. On the stand are two mechanical devices showing most of these units in action. An interesting selection of photographs showing installations in various parts of the country are also on view.

One of the largest exhibits of the Fair is that of **Stewarts and Lloyds, Ltd.,** which, with its subsidiary Companies, occupies four main stands. In the Engineering Group are displayed a wide cross-section of the Company's standard products, comprising steel tubes and fittings for the conveyance of steam, gas, water, air, oil, and sewage, a variety of joints and couplings, tubular steel coils, and a selection of foundry pig irons and iron and steel casings. In the Building Group, under the name of John Russell & Co., Ltd., gun-metal valves and fittings for steam, water and gas, gun-metal radiator valves, pipe fittings screwed for iron and copper, and hose connexions, are shown. Examples of fabricated tubular steel products such as a large footbridge are on view, while in the Fair cinema is shown the film "Job 99—Pluto," a record of one of Stewarts and Lloyd's wartime achievements. A light portable crane, a folding artesian well drilling rig, a 50 ft. welded steel tubular gangway, and many other exhibits make this a notable display.

Among the exhibits on the stand of **E. Boydell & Co., Ltd.,** are three new products, two of them dumpers, and one a shunting tractor. Of the three dumpers shown, the 10B has a struck level capacity of 2½ cu.yd.; the 14B of 3½ cu.yd.; and the 20B of 5 cu.yd. The last two are the new models and possess many novel features. The 14B is powered by a six-cylinder Diesel engine, with a double gear box giving four speeds in either direction, the top gear giving up to 25 m.p.h. The 20B model is heavier and is capable of 30 m.p.h. in top gear for road use.

Decorative and protective finishes for gas-works plant and consumers' appliances are displayed by **Donald Macpherson & Co., Ltd.** Their gasholder paints, from priming coats to finishing, embodying the latest developments in both pigments and media and provide maximum inhibition from corrosion and stability against conditions which vary from heavily chemical laden industrial atmospheres to the bright sunlight and salt air of seaside resorts. Isomerized oils are now being used by this Company with success and isomerized linseed oil has been found to improve the durability of the paint films in which it is used, being particularly suitable for incorporation with synthetic resins, giving toughness and extreme resistance to water absorption, chemicals, weather and abrasion.

New technique in filing cabinet design is demonstrated by **The Shannon, Ltd.,** the open drawer swinging out pivotally lengthwise, thus protruding into the room no more than the depth of the drawer. The innovation is clearly valuable in saving space and the Shannoswing cabinet is attractively constructed in walnut and mahogany. Of equally neat design is the Shannograph, a remarkably effective filing system in which every file is separately hung and colour-charted. Many other examples of Shannon products are on show, including lever file clips, perforators, Eagle clips, &c.

The Aerograph Co., Ltd., exhibit a large selection of Aerograph DeVilbiss spray-painting equipment, including the very compact Type MBC spray gun. Other types of spray gun, pressure feed tanks, air transformers and pressure regulators, air compressors, exhaust fans, and petrol-driven and electrically-driven complete portable spray painting outfits are also shown.

The two most interesting devices displayed on the stand of the **Rawlplug Co., Ltd.,** are Toggle bolts and Rawlanchors. The former, which are widely used in prefabricated house construction, consist of a metal member suspended on the end of a screw. When the member is pushed through the hole in the material, the longer side falls by pull of gravity, and the screw can be turned back until the member is drawn tight against the back of the material. The Spring Toggle is a variation. The Rawlanchor is entirely differently constructed and comprises a flexible shell which is pushed into the hole in the material and when screwed up collapses against the back of the material and becomes anchored. Because of this anchorage the screw can be withdrawn and replaced at any time. In addition, the usual products, such as Rawlplugs, Rawlbolts, and fixing tools are exhibited.

The Manchester Oil Refinery, Ltd., have two stands, one in the Engineering Section, and one in the Chemical Section. The former shows a large selection of oils for industry, each suitable for a specific purpose. The other stand exhibits petroleum-derived chemicals for special uses.

We learn as we go to Press that the British Industries Fair has met with a record reception, 88,000 people visiting the Birmingham section during the first five days—a figure more than double that for the same period in 1939. In London, at Olympia and Earls Court, home trade attendance for the first five days was 85,628, and 11,988 of the general public visited the Fair.

Opportunities in the Foundry

Realizing the serious problem of acute shortage of labour in general and of apprentices in particular, together with the more serious production problem in the future, the Stanton Ironworks Co., Ltd., have maintained for some time a policy of training. They have proceeded a stage further towards the completion of their existing training scheme by the erection of a fully equipped training centre which will be in operation towards the end of June. The new centre will comprise foundry, engineering, and woodwork departments, each under the supervision of full-time instructors.

The foundry training section will be a complete foundry unit, the equipment of which is designed to instil into the boys the fundamental principles of good foundry practice. The only mechanical aids will be the sand preparation and handling plant, comprising a knock-out grid with conveyor belt and magnetic separator for the return sand, which passes through a rotary screen before being elevated to the storage bunker. Dust from the sand preparation plant will be removed by a dust extraction plant.

Apprentice patternmakers will receive their basic training in the patternmaking department, and in order to develop craftsmanship, the training will be directed principally towards handwork. The engineering and woodworking sections are to be fully equipped with the necessary machine and hand tools, and boys who are to become apprentices in the various trades will receive a comprehensive basic training. Those who enter employment in which apprenticeship is not involved, proceed to their future department after the first month of training and are then given an opportunity to return to the centre for handicraft instruction in order to stimulate an interest in the proper use of leisure.

For theoretical training, the centre will include a cinema and classrooms equipped with filmstrip projector, epidiascope, and other visual aids to instruction, and a technical library will meet the need of all apprentices and students. Films and filmstrips produced by the Company will illustrate its own particular products and organization and give recruits a knowledge of the firm, its products, processes and place in the industrial community.

The Company's aim is to stress the importance of training, to interest and attract the future craftsmen, and so equip them with a higher degree of skill, and to give the foundry technician a wider basis of knowledge and experience on which future developments of the industry can be built.

Gas Undertakings' Results

Shirebrook and District Gas Company.—The Directors report a profit of £8,294 for 1946, and recommend payment of a dividend of 12½%, of which 4% was paid on Aug. 31, leaving £8,398 to be carried forward, against £7,667 brought in.

Australian Gas Light Company.—Net profit for the year to Dec. 31, including £106,402 brought forward, amounted to £429,704. Of a total revenue of £3,181,179, gas sales amounted to £2,837,766; expenditure was £2,747,118, and £434,060 was carried from working account to profit and loss account. An interim dividend of 3% was paid in August and a final dividend of the same amount, making 6% for the year, leaves £138,104 to be carried forward.

Imperial Continental Gas Association.—The Directors will recommend at the annual meeting on June 6 an Ordinary dividend of 7% and a special dividend of 1½%, both less tax, making 8½% actual. Net profit for the year ended Mar. 31, after providing for taxation, amounted to £263,883, of which £217,432 was attributable to the year 1946-47 and £46,451 to the previous year. The proposed dividends, less tax, require £261,800, leaving a balance of £2,083 to be added to the carry forward.

Leamington Priors Gas Company.—Gas sales in 1946 were 11.9% higher than in 1945 and 46% above the 1939 figures. Output has doubled since 1930 and nearly trebled since 1914. Presiding at the annual meeting, Dr. H. Mason said the balance of profit and loss account was maintained at the satisfactory level of £11,885. Referring to the prospect of nationalization, he said that if the Electricity Bill became a precedent for a Gas Bill shareholders were faced with a reduced income which would be a real hardship to the majority. Shareholders were not, in the main, wealthy people. The average holding in the Leamington Company was £300 and a reduced income on such a relatively small amount of capital investment was a serious matter.

Maidstone Gas Company.—Balance carried to net revenue account for 1946 was £9,527, as against £17,692 for the previous year. Gas sales last year were 4% higher than in 1945 and no less than 37% above the sales for 1938. Throughout the severe winter a satisfactory supply of gas was maintained. After providing for interest, the profit available on the year was £7,982, to which is added the balance of £10,069 brought forward. At the annual meeting on May 8 the dividend on the Capital stock was made up to 8%, less tax, for the year 1946, which is the rate permitted under the Gas (Maximum and Standard Prices) Order and General Direction, 1942, being 1% less than the average rate of dividend paid for the three years before the war. After payment of dividend, £10,759 remains to be carried forward.

Lea Bridge District Gas Company.—In his statement issued with the report and accounts, Mr. A. E. Sylvester, Chairman, reports that as the result of the year's working, £75,064 remains to be carried to the net revenue account, an increase of £17,050 on last year's figure. The net revenue account contains the usual charges for interest and income tax, and a transfer of £36,122 to the works renewals suspense account to write off the cost of work carried out in the reconstruction of one of the retort houses. The profit on the year, after making this transfer, is £19,687. After paying the dividends for the half-year ended June 30, and taking in £30,175 brought forward from last year, an amount of £43,312 is available for distribution. The Directors recommend the declaration of the usual preference dividends for the half-year ended Dec. 31, together with a dividend on the Consolidated Ordinary Stock for the half-year at 7¼% per annum. Payment of these dividends and the co-partnership bonus for the year will absorb, after deduction of income tax, £10,760, leaving £32,552 to be carried forward to the current year. The outstanding feature of the year was the consistent increase in the output of gas each month, culminating in a record output for the month of December, when the daily output exceeded the previous year's maximum on 13 days. The increase in output is shared fairly evenly by domestic and industrial consumers; 33.5% of the total output is accounted for by the industrial load, and this is still increasing. During 1946, despite the restriction on building and the shortage of appliances, there was a net gain of 141 consumers, and 341 cookers, 364 fires and 832 water heaters were installed. Reconstruction of the continuous vertical retort house was completed in 1946, and with the help of the additional plant the Company was able to maintain full pressures on the district throughout the past winter months, until instructed by the Ministry of Fuel and Power to reduce pressures to conserve coal. Good progress has been made with repair of war damage and picking up arrears of maintenance of buildings and plant. In order to meet the continued increase in demand for gas, orders have been placed for additional plant, but a long delay in the delivery of this must be expected.

Gas Stocks and Shares

The statement by the Chancellor of the Exchequer regarding Britain's overseas indebtedness had a stimulating effect on the stock market and prices rose in most departments. Throughout the week British Funds were in demand at rising prices. A contraction of business in the industrial market followed Sir Stafford Cripps's statement regarding the value of exports lost as the result of the fuel crisis, but share prices showed no tendency to fall; several departments, in fact, continued to improve, though business tended to become more quiet towards the week-end.

In the gas stock market Gas Light and Coke Ordinary ended the week 1s. higher at 22s. 6d.-23s. 6d., advancing by 3d. on two or three successive days, and the 3½% Redeemable Preference stock also gained one point on the week. Slight advances were recorded in South Metropolitan, South Suburban, Tottenham, and Wandsworth stocks. On the other hand Imperial Continental dropped one point. Ex-dividend quotations for Montevideo Ordinary were 12 points below the price ruling the previous week.

Rises and falls in gas stocks during the week were as follows:

OFFICIAL LIST

Alliance & Dublin cons. ord.	21/6—23/6	— 1s.
Assed. Gas & Water U'd'tgs deferred (x.d. April 30)	18/6—20/6	+ 6d.
Gas Light and Coke ord.	22/3—23/3	+ 1s.
Do. 3½ p.c. red. pref.	99 —102	+ 1
Hampton Ct. 5 p.c. cons. ord.	103 —108	— 2
Hornsey 3½ p.c. std.	95 —100	+ 2
Do. 5 p.c. std.	120 —125	+ 3
Imperial Continental cap.	132 —137	— 1
Montevideo, Ltd. ord. (x.d. April 30)	128 —133	— 12
Oxford, cons. ord.	170 —180	— 10
Primitiva Holdings, Ltd. ord.	12/6—14/6	— 6d.
South Metropolitan ord.	93 — 96	+ 1
South Suburban ord. 5 p.c.	110 —115	+ 2
Swindon cons. ord.	113 —118	— 4
Tottenham ord.	110 —115	+ 3
U. Kingdom 4½ p.c. 2nd non.cum. pref.	19/—21/-	+ 6d.
Wandsworth cons.	110 —115	+ 2

Gas Products Prices

The London Market

May 10.

There are no changes to report in the prices of Coal Tar products.

The Provinces

May 12

Average prices for gas-works products: Pitch, 75s. per ton; toluole, naked, North, 90's, 2s. 4d. to 2s. 6½d. per gall.; pure, 3s. 2½d. Prices for carbolic acid 60's anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.) and strained anthracene oil are controlled by Government Orders. Prices for road tar are increased by one penny per gall. by S. R. & O. 1947, 177, under which Order there are also increases in the prices of naphthalene.

Scotland

May 10.

Production tends to be on a lower scale.

*Refined Tar.** Yield to the distiller is 6d. per gall. ex works, naked. *Creosote Oil.* Timber preserving quality* 5½d. to 6½d. per gall.; Hydrogenation Oil* 5⅜d. per gall.; Low Gravity or Virgin Oil† 7½d. to 7½d. per gall.; Benzol Absorbing Oil 6½d. to 8d. per gall. *Refined Cresylic Acid* is 3s. 6d. to 4s. 6d. per gall. ex works, naked, according to quality. *Crude Naphtha*† 7d. to 8d. per gall. *Solvent Naphtha.** Basic maximum prices delivered in bulk 90/160 grade, 2s. 10d. per gall., and 90/190 Heavy Naphtha, unrectified, 2s. 0½d. per gall.; Rectified, 2s. 4d. per gall. *Pyridine.*† 90/160 grade 15s. per gall., and 90/140 grade 17s. per gall.

* Price controlled. † Uncontrolled

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GAS METERS